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The Health and Customs of the Miskito Indians of Northern Nicaragua: inter-relationships in a medical program

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PREFACE

114 This medical survey and the health program connected with it was conceived by Mr. John Collier, who was Commissioner of Indian Affairs, Dr. Manuel Gamio, the Director of the Inter-American Indian Institute, and the Committees of Health and Sanitation of the National Indian Institutes of the United States and Nicaragua, and the Office of Inter-American Affairs.

121 The primary purpose of this study was to ascertain by what measure a health program could be initiated in a sequestered low-land tropical region for inhabitants who were autoctonous Indians to that area. The survey and the program were by no means complete since the main efforts were directed to the salient problems pertinent to the health of the people. Furthermore, considerable emphasis was given to the customs and habits of the Indians since any program in order to survive must be fitted into the lives of the people and the circumstances of the local situation. And, since the writer was specializing in the field of nutrition, the subject received disproportionate study.

122 123 The limitations of this study can be set forth. The first of these was the short time spent in the Coco Basin, a period of two months hardly being sufficient for a medical survey. The second was that no specific exhaustive anthropological method was used to study the social behavior of the Indians. But this second limitation is of no great consequence since the procedures ordinarily employed have not as yet attained quantitative values. But time should have been taken to gain a further insight into the views which these Indians held with respect to medical care. So far the authors' meagre observations form the only data from which to infer conclusions; certain "single methods" were employed and it is not too sanguine to state that still more important factors in the life, as it affects Public Health of these Indians are yet to be ascertained. Without, however, anticipating future inquiries, there is presented herewith those factors, medical and social, which the investigator deemed as sufficient in quantity to allow a recommendation for the health program of the Miskito without disrupting the social values of these people.

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The ideal procedure would have been to have had a team composed of various specialists, medical, sociological and anthropological, working together in a cooperative way in a thorough study of the Miskito Indians.

It must be acknowledge that we were fortunate enough to find one physician who had established himself over a period of years in the area in question. This fact made the work much easier and obviated the use of time to form contacts with Indians. This made it possible to have the work continued with a reasonable assurance of success.

The writer wishes to thank the members of the sponsoring committee: Dr. Clark H. Yeager, Mr. Ernest E. Maes, Dr. J. R. Murdock, Mr. Watson Davis, Mr. J. E. Johnson, Miss Sally Lucas Jean and Lt. Comdr. A. H. Leighton, M. C. USNR. He also acknowledges the guidance of his Commanding Officer, Capt. E. G. Hakansson, M. C., USN, who has had considerable experience in the study of tropical disease. One cannot but praise the unselfish devotion of Dr. David A. Thaeler, who has lived for many years in Central Nicaragua, and who has consecrated his career to the health of the Miskito Indians. Thanks are given also to Dr. Leonard Rosenfeld, Dr. Lorenzo Guerrero and Col. Luis Manuel DeBayle, for their generous assistance. The study, furthermore, was dependent on my associates, Mrs. Angela S. McCutcheon, Dr. Leopoldo Navarro, Dr. David Ocon, and Dr. H. Fonseca, who gave much of their time in the field survey.

Appreciation is expressed to Wyeth Incorporated, who generously supplied many of the drugs used in this survey and who defrayed many of the technical expenses of this study.

HISTORICAL BACKGROUND

The eastern coast of Honduras and Nicaragua was discovered by Columbus in 1502, during his fourth and last voyage to the New World, when he was proceeding from Trujillo in Honduras to Nombre de Dios in Panama. However, he did not come in direct contact with the Indians of this area.[1] In the course of the following years the Spaniards endeavoured to take possession of this territory but the natives resisted most of the efforts of the colonisers. The Spaniards were chiefly in quest of loot but since gold was not found and the Indians gave them no end to trouble they centered their interests and energies upon the Pacific Coast.

Vague mention was made of the Atlantic seaboard Indians by Gon-

[1] Conzemius, E. Ethnographical Survey of the Miskito and Sumu Indians of Honduras and Nicaragua. Smithsonian Institution, Bull. 106, 1932.

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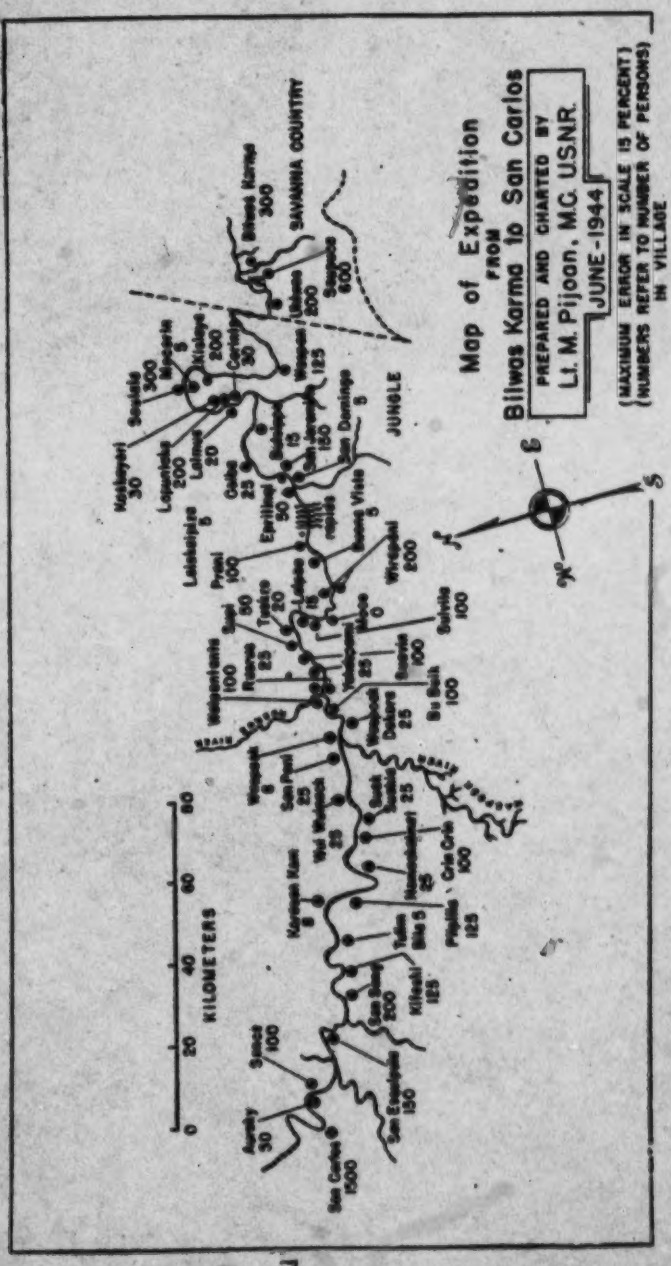

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114 Vague mention was made of the Atlantic seaboard Indians by Gon-
175 zalo Fernández de Oviedo (1478-1557) who was residing temporarily on the Pacific Coast of Nicaragua. A better account was given by the Franciscan missionary Espino[2] who had lived on the eastern coast during the year 1667-1668 (Río Patuca). It was during this period that the English entered into friendly and commercial relations with Indians; British traders arrived with increasing frequency and eventually garrisons were established. During this period there was also considerable trade with English buccaneers. The author of the first scholarly work on buccaneers, A. O. Exquemelin (English: Esquemeling; French: Oexmelin), came to the West Indies in 1666 and visited the Mosquito Coast of eastern Nicaragua in 1671. He had joined the buccaneers and had apparently assumed the function of barber-surgeon. It was, at any rate, in this capacity that he accompanied Morgan on his famous raid on Panama in 1671.[3] Exquemelin's original work in Dutch (Amsterdam, 1678), later translated into German (1679), Spanish (1681), English (1684), and French (1686), not only forms the basis for all of the popular accounts of the Seventeenth Century buccaneer captains but yields important descriptive information of the places he visited, especially the Mosquito Coast. Following Exquemelin, numerous other early historiographers have made accounts of the territory (vide: Dampier[4] Raveneau de Lussan[5] Sloane[6]).

175 In 1786 by virtue of a treaty with Spain, Great Britain agreed to yield the territory and to recognize the sovereignty of the King of Spain over it.[7] Somehow the Spaniards were unable to maintain a foothold in this area, a situation presumably due to the persuasive power of the English over the Indians in encouraging hostility towards the new government. In 1821 the States of Central America declared their inde-

[2] Espino, Fray Fernando. Relación Verdadera de la reducción de los Indios infieles de la provincia de Taguisgalpa, llamados Xicaques, cuyos operarios han salido, y salen desta provincia del SS. Nombre de Jesús de Goatemala, desde 1612, hasta el presente año de 1674, Guatemala, 1674.

[3] Exquemelin, A. O. De Americaensche Zee-Rovers, Amsterdam, 1678; Amerikanische Seeraüber, Nurnberg, 1679; Piratas de la América, Kola, 1682; Bucaniers of America, London, 1893; Histoire des Aventuriers qui se sont signalez dans les Indes, 2 vols., Paris, 1686.

[4] Dampier, William. A New Voyage Round the World. Fourth edition, 2 vols., London, 1699.

[5] Raveneau de Lussan. Journal du Voyage fait à la Mer du Sud, par les Flibustiers de l'Amerique en 1684 et années suivantes. Paris, 1689.

[6] Sloane, Sir Hans. A voyage to the Islands Madera, Barbados, Nieves, S. Christophers and Jamaica, etc. 2 vols. London, 1707-1725; A New History of Jamaica from the earliest accounts, etc. Second edition, London, 1740.

[7] Stout, Peter F. Nicaragua: Past, Present and Future. Philadelphia, 1859.

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pendence from Spain and the English authorities from Jamaica renewed their friendly relations with the Indians. In fact, one of the chiefs from the area was crowned with solemnity by the British at Belize, British Honduras, and made king, thus reestablishing a British protectorate system. The "Mosquito" (Miskito) Kingdom in those days included the whole Atlantic Coast of Central America from Chiriqui Lagoon (latitude 9° N.) to Cabo Honduras, a coastline of 700 miles.[7] However, in 1847 the territory became restricted to the territory between Cabo Honduras and Río San Juan, the jurisdiction of which was under British colonials. During these years under British supervision Orland W. Roberts,[8] an active trader on the eastern coast of Nicaragua, gave an accurate account of Miskito Indian customs. Reports were also given by Young,[9] Fröebel,[10] the most important being the text by Bell,[11] who lived in the territory from 1846 to 1862. From 1863 to 1868 John Collinson, a civil engineer, made two voyages to this coast and left an account of his travels.[12] H. A. Wickham,[13] (1867-1868) made a collection of birds from Río Escondido and Pearl Lagoon; P. Levy made researches for the Nicaraguan government[14] and other studies were made by the Swedish zoologist Bovallius,[15] and by K. Von Girsewald, [16] B. Mierisch,[17] and K. Sapper, who obtained a series of ethnographical specimens for the Stuttgart Museum.[18]

Inasmuch as there is a considerable admixture of Negro with the Miskito Indians it may be well to examine the possible reason for this

[8] Roberts, Orlando W. Narrative of Voyages and Excursions on the East Coast and in the Interior of Central America. Edinburgh, 1827.

[9] Young, Thomas. Narrative of a Residence on the Mosquito Shore, During the Years 1839, 1840 and 1841. London, 1895.

[10] Fröebel, Julius. Aus Amerika. Erfahrungen, Reisen and Studien. 2 vols. Leipzig, 1857-1858.

[11] Bell, Charles Napier. Remarks on the Mosquito Territory; its Climate, People, Productions, etc. Journal of the Royal Geographical Society, 1862, 32, 242-268. London.

[12] Collinson, John. The Indians of the Mosquito Territory. Memoirs of the Anthropological Society of London. 1870, 3, 148-156. London.

[13] Wickham, H. A. Notes of a Journey among the Woolwa and Mosquito Indians. Proceedings of the Royal Geographical Society. 1869, 13, 58-63. London.

[14] Levy, Paul. Notas geográficas y económicas sobre la República de Nicaragua. Paris, 1873.

[15] Bovallius, Carl. Resiai Central-Amerika (1881-1883) Upsala, 1887.

[16] Girsewald, K. Von. Sechs Monate in Nicaragua. Braunschweig, 1896.

[17] Mierisch, B. Eine Reise nach den Goldgebieten in Osten von Nicaragua. Petermanns Mitteilungen. 1893, 39, 25-39. Gotha.

[18] Sapper, K. Reise auf dem Rio Coco (Nordlickes Nicaragua). Globus, 1900, 78, 249-252, 271-276, Braunschweig; Proceedings of the Nineteenth International Congress of Americanists, 1917, 206-210.

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In 1875 at the time when the relationship of Miskito and Sumu languages was still unknown, Zúñiga Echenique[19] considered the Miskito Indians as the offspring of fugitive slaves with *Twahka* women (see appendix A). Of the existing Sumu tribes today the *Bawihka* is the one wich linguistically and ethnologically is the closest to Miskito. The *Bawihka* formerly occupied the area of the coastline where the first Europeans made contact. The fact that Echenique had suggested that the Miskito were derived from slaves and Indians and the fact that the *Bawihka* were on the coast induced Conzemius[1] to deduce that intermarriage between Negroes and Indians, an ordinary occurence today, was a possibility in earlier times.

In 1641 a slave ship was wrecked off Cabo Gracias a Dios. The Africans were on a ship commanded by Lourenço Gramalxo.[20] While on the high seas the Negroes revolted and mastered the ship and not knowing navigation allowed the vessel to be carried by trade winds, where it became wrecked on the Mosquito keys. The Negroes reached the mainland and were made slaves by the Indians. However, they were allowed to inter-marry and their children became free members of the tribe. There appears to be some controversy as to the owner of the vessel and the year it foundered.[21 y 22]

As a result the Miskito from Cabo Gracias a Dios to Sandy Bay developed an admixture of African blood. This Mixture was enhanced by the coming of other refugee slaves and the more recent immigrations of Negroes and mulattoes from the West Indies. The extent to which the Indian language was influenced by the African newcomers is unknown; the vowel scale of many people in certain villages is the same as the Jamaican creole dialect.[23 y 24]

In recent times important contributions with regard to the Miskito

[19] Zúñiga Echenique, Melquisédec. Descripción geográfica del departamento de la Mosquitia, practicada en el año de 1875. Madrid, 1905.

[20] Vide: Peralta, M. M. Costa Rica y la Costa de Mosquitos. Madrid-Paris, 1898; footnote N° 3; Edwards, B. The History, Civil and Commercial, of the British West Indies, 5 vols. London, 1819. Heath, G. R., quoted by Conzemius (footnote 1), loc. cit. p. 17.

[21] De Kalb, Courtenay, Nicaragua: Studies on the Mosquito Shore in 1892. Jour. Amer. Geographical Soc. of New York. 1893, *25*, 236-288. versus opinion expressed by Peralta (footnote 20).

[22] Lehmann, W. Ergebnisse einer Forschungsreise in Mittelamerika und Mexico. Zeitschrift fur Ethnologie, 1910, *42*, 687-749.

[23] Conzemius, E. Notes on the Miskito and Sumu Languages of Eastern Nicaragua and Honduras. Internat. Jour. Amer. Linguistics, 1929, *5*, 57-115.

[24] Heath, G. R. Notes on Miskito Grammar and on Other Indian languages of Eastern Nicaragua. Amer. Anthropologist. 1913, *15*, 48-62.

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In recent times important contributions with regard to the Miskito 114
Indians have been made by H. J. Spinden,[25] A. H. Schultz,[26] D. E. Harrower[27] and the exhaustive investigations of E. Conzemius.[28]

THE TROPICAL SITUATION

The status of peoples living in the tropics and semi-tropical regions 262
varies considerably, depending on environment and man's adaptation to his habitat.[29]. Different foods are produced under different conditions. Thus, in the inner jungles and in certain highlands, very little food may be available; along the rivers it may be plentiful, and along the seashore other food sources may manifest themselves. Climate, geography, and socio-economic factors have a direct bearing on food availability and consumption.[30] Food habits naturally follow a similar 262
pattern: the classical tortilla of Mexico and the Middle American coun- 177
tries; the use of manioc in the Amazon area; the dehydrated potato (chuño) of the Andean altiplano, the all too starchy diet which has developed in the Caribbean areas, all have their explanation in the factors typical of each area. Furthermore, when natives come into contact with other cultures, deculturation processes in the dietary pattern often take place.[31] These deculturation processes are not limited to clashes between Indian and white cultures, such as prevail in most of Latin America, but to the adaptation and absorption of dissimilar cultures not of Indian origin, such as in Puerto Rico and the southwestern States of this country, where the Hispanic and the Anglo-Saxon mode of life meet. Procurement of food in industrial areas by low income groups may modify the diet considerably. With this in mind no gene-

[25] Spinden, H. J. The Chorotegan Culture area. XXI° Congrès International des Americanistes (529-545) Goteborg, 1925.

[26] Schultz, A. H. Anthropological Studies on Nicaraguan Indians. Amer. Jour. Physical Anthropology, 1926, *9*, 65-80.

[27] Harrower, D. E. Rama, Mosquito and Sumu, of Nicaragua. Museum of American Indian, Heye Foundation. 1925, *2*, 44-48.

[28] Conzemius, E. (see footnotes Nos. 1 and 23), also: Die Rama Indianer von Nicaragua. Zeitschrift fur Ethnologie, 1921, *59*, 291-362 (Berlin); Apuntes sobre algunos Nombres Geográficos Mosquitos en Costa Rica y Panamá. Revista de Costa Rica, 1922, 300-306; Les îles Corn de Nicaragua. *La Geographie*, 1929, *52*, 346-362 (Paris).

[29] Pijoán, M. Certain Factors involved in the Struggle Against Malnutrition and disease. Univ. of New Mexico Press, 1943. Inter-Americana Monographs.

[30] Eggan, F., and Pijoán, M. Some Problems in the Study of Food and Nutrition. América Indígena. 1943, *3*, 9-25.

[31] Pijoán, M., and Elkin, C. A. Secondary Anemia due to Prolonged and Exclusive Milk Feeding Among Shoshone Indian Infants. Jour. Nutrition, 1944, *27*, 67-75.

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ralization can be directly applied to diets in the tropics: the galaxy of nutritional factors are determined by the local situation and the food habits of the people.

The same can be said of tropical infectious disease. The variety of vectors, their ecological relations to circumstances determined by altitude, rains, swamps, climate and vegetation limit disease entities to special regions even though many diseases occur throughout the world. It must be remembered that to the diseases generally present among people are added those which are peculiar to a new environment and that modifications of a disease can take place. For instance, whooping cough is a serious disease attended with a high mortality rate in Central Nicaragua, whereas scarlet fever produces a mild disease often unrecognized. Whether the host or the organism is responsible for such a condition is not known and the problem of host and parasite interrelationships becomes a complex one.

THE MOSQUITO AREA: THE LOCAL SITUATION

The vast region on the Atlantic side of Nicaragua and Honduras is known by the name of Mosquito coast. It is inhabited buy four different tribes of Indians: The Miskito, the Suma (Sumu), the Paya, and the Rama. In some localities the Miskito, often incorrectly called Mosquito, have a considerable admixture of Negro blood and, for this reason, are in some places called Zambos. The other three tribes, however, are practically of pure Indian blood. In earlier times, the western region of the Mosquito coast was occupied by the Matagalpa Indians, whose language extended over a large area in Nicaragua and Honduras, but has been extinct for nearly half a century. However, a dialect of its is spoken to this day by the older inhabitants of the Salvadorean villages of Cacaopera and Lislique. Today the Indian languages of the area are somewhat interrelated, especially Matagalpa, Miskito, and Suma; Paya is an unrelated language.

The Miskito and small isolated bands of Suma Indians inhabit the eastern side of Honduras and Nicaragua. They are found from the Río Tinto (lat. 15° 50′ N.) to Río Punta Gorda (Lat. 11° 30′ N.). The villages are located chiefly along the banks of the rivers as far up as the headwaters within the jungle proper. The Suma Indians are found primarily in the interior; they are somewhat uncommunicative, but cooperative. The Miskito are self-sustaining and at times derive additional income from labor with fruit companies, mining enterprises and rubber collecting agencies. Today they play an important part in the wild rubber collection program.

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The Miskito Indians, numbering about 20,000, are a mixed race, since there has been much inter-marrying with negroes, creoles, Spaniards, Caribs, Sumu, Syrians and Chinese. About one-half of them have negroid physical characteristics, another third non-specific physical features and a few appear to be of pure Indian blood. There is, however, the same behavior pattern in all of them; they live together and there is no cultural differentiation on a physical basis. The culture and language are predominantly Indian, though some of them speak a little English or Spanish. The name "Mosquito Coast" may have been derived from the Indian tribe, the Miskito, or it may have been derived from the numerous mosquitoes found in the area.

The climate is humid and tropical. The average temperature along the seacoast rarely registers below 65° F. or above 90° F. Such pleasant temperatures are due to the trade winds that blow fairly steadily for about seven months of the year. From Bilwas Karma inland, the heat is intense, humid, and at times unbearable. At higher altitudes near the headwaters of the Coco (or Wanks) River, conditions are less severe. The whole area is well watered by many streams which empty into the larger rivers, which in turn drain into the Caribbean sea. In the jungle area these rivers are the only means of communication or transport. During flood times the rivers rise tremendously, often as much as thirty feet in a single night, the crumbling banks bringing down trees and everything along the edge. For this reason the villages are built high up on the banks and usually some distance from the stream. The average rainfall is reported to vary from 250 to 320 inches a year. There are two dry and two set seasons each year, but these conditions are only relative, since it is always humid in the interior. The dryest seasons are from about March to May and from late August to early October. The remainder of the time it rains almost incessantly, sometimes all day. In the dry season light showers occur frequently. These geophysical conditions contribute significantly to the food-agricultural status of the people.

Geographically the area can be divided as follows: along the seashore it is sandy, with an inland belt of about twenty miles, consisting of swamps; then an area fifty to one hundred miles wide of intermittent savannah, and finally the thick, dense, somewhat impenetrable jungle which covers everything, even the mountains. Violent winds and hurricanes are not infrequent.

Besides the Miskito and the Sumu, two other Indian tribes, the Paya and the Rama, live in eastern Nicaragua. The population of these tribes is unknown, but it is considered to be about 500. Conzemius[1] reported in 1932 that they numbered about 700 but stated that they

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were dying out rapidly, which may account for the lower figure now given. The Rama tribe, of about 200 members, living along the lagoons near Bluefields, has become a sort of slum population; its existence on the edge of the rough seaport village subjects it to the whims and volition of all and sundry. From the Río Tinto northward live the Black Caribs, descendants of the aborigines of St. Vincent Island. In and about Bluefields, Pearl Lagoon, San Juan del Norte, and on the islands, the inhabitants are largely mulattoes; Negroes as well as mulattoes are also found in the coastal towns.

MORPHOLOGICAL CHARACTERISTICS OF MISKITO AND SUMU

The Miskito Indian is generally well built, of middle height whereas the Sumu Indian is rather thickset and of lower stature. Both are proportionally broad shouldered, have beep chests and are heavy muscled. Schultz[20] found the average measure of the adult Sumu and Rama to be 1.5816 m. It is also obvious to any observer that the arm and chest muscles are developed somewhat out of proportion to the leg muscles. This may be due to the fact that these people are essentially canoe (pipante) folk whose chief method of travel consists of river boating. In fact, most of their enterprise is carried out by the use of a boat and the use of arm and torso muscles any exceed those of the lower extremities.

In our studies at Waspam and Saulpuca the weights and heights were noted in a series of individuals with reference to their age. It is apparent that diet plays a role in development[22] but since it will be shown later that the nutrition of these people is adequate in the light of present day criteria, the figures reveal presumably the inherent constitutional morphology of surface area. And since the changes in height and weight vary with the age of the individual it is important to take this factor into account.

It is to be noted that the figures are averages and do not reveal variation. Since the major part of growth occurs between birth and twenty years of age[23] the values given represent the peak of surface area development and the initial phases of further weight gain. However, measurements are no better than their definition and the indivi-

[22] Palmer, C. E. Growth and the economic depression. Pub. Health Reports. 1934, 48, 1277-1292.

[23] Krogman, W. M. The Growth of Man. Tabulae Biologicae. 1941-42, 20, 1-967. Junk, Den Haag, Nederlands (delayed in press because of war).

[24] Krogman, W. M. Human Growth. Ciba Symposia, 1943, 5, 1458-1485.

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dual doing the measuring and much over-emphasis has been placed on this subject.[24] Thus the data are used only as an approximate impression and categorically support clinical observation and conclusions. [41]

Average weight and height of Miskito men and women relative to their age

All years	Sex	152	158	160	165	170	175
			Height (cms)				
			Weight (kilo)				
18-20	M	55.1 (10)*	58 (8)	61 (13)	—	—	64.2 (6)
20-21	M	58.6 (5)	60 (14)	62 (21)	64.6 (6)	65 (6)	64.0 (4)
21-24	M	59.2 (5)	—	61.8 (4)	64.6 (9)	64 (6)	65.0 (4)
25-32	M	66.0 (9)	67 (13)	71.0 (19)	75 (19)	77 (13)	76.0 (2)
18-20	F	60.2 (13)	63 (14)	65.0 (17)	65 (3)	—	—
20-21	F	62.4 (11)	65 (20)	65 (19)	68 (7)	—	—
25-32	F	70.0 (20)	72 (19)	73 (13)	75 (8)	—	—

* Numbers in brackets indicate number of people examined of the same age.

The averages may be further computed for the age groups in question and at 19 years of age may allow for the following comparison:

Comparison of nineteen-year-old subjects
(Height in cms)

Sex	*Present Survey* Miskito Indians	*Taken from Krogman*[24] American Chicago	American Negro	German	Japanese
M	162	176	172	174	158
F	169	164	160	165	146

It can be seen from these data the women grow to be about as tall as the men but from the previous table they also tend to become more obese or add more weight than the men. They appear to be generally of shorter stature than those of us who visited the area and this notion is supported by measurements. It must be noted, however, that these people (Waspam, Sandpaper) were upper river folk and cannot be correctly compared with the data obtained by Schultz[25] who studied twelve Sumu Indians from Río Prinzapolca and twenty five Rama Indians from Rama Key. There appears to be, furthermore, slight differences in weight and height within the tribe. These variations are more pronounced in coastal towns, where the socio-economic level is poor by comparison [51]

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comparison. The dietary in urban areas of coastal ports is predominantly one of imported and home grown cereal grains, wereas the river Indians consume a greater quantity of meats and fresh fruits. On the basis of the investigation by Roberts[33] it may be presumed that the variation in diet may account for the impairment of growth of coastal Indians. In specific physical anthropology there is sufficient reference elsewhere (vide Schultz[34]).

The Miskito Indians have an abundance of hair growth extending low over the forehead; it is scarce on other parts of the body. The hair is commonly black and very straight, although several Indians were noted who had reddishbrown (a metallic auburn) shade of hair. Gray and white hair rare and beard growth is very scarce. Chest and pubic hair is absent among pure Indians.

Although there are no accurate figures dealing with longevity the impression gained was that once an Indian lived to be over twenty years of age he had good chances for old age. Conzemius[1] in 1922 met a number of Indians who were young children during the volcanic eruption of Coseguina on the bay of Fonseca in 1835. Our survey revealed a number of Indians who remembered missionaries who had been in the territory sixty or seventy years ago. The Indians themselves informed us that many die between the ages of fifty and sixty years of age, with the chief cause of death being the fever (malaria). As will be shown, infectious disease takes a heavy toll of life during infancy and in early senescence. It is to be noted that the situation may change and the death rate in later life may increase. In former days sickly and deformed children were either buried alive or starved to death. Only the strong and healthy were allowed to grow up. Today there is no such control; Indians with deformities will secrete them or bandage the part involved; tolerance to diseased people has increased.

GENERAL CUSTOMS OF THE MISKITO

Today the men wear loose cotton shirts *(prak)* and trousers *(transis)*; the shirt tails are usually not tucked in. The older boys wear a similar garment but commonly among youngsters the dress is chiefly a loin or breech cloth *(palpura)* or nothing at all. Many of the women wear dresses *(prak)* although some of them and the girls wear a piece of cloth *(kwaluntara)* which is wrapped about the hips and extends

[33] Roberts, L. J.; Blair, R.; Lemming, B., and Scott, M. Effect of a milk supplement on the physical status of institutional children: I. Growth in height and weight (pp. 287-300), II. Ossification of the bones of the wrist (pp. 494-509), III. Progress of dental caries (pp. 805-823). Amer. Jour. Dis. Children, 1938, 56.

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from the waist to the knees. Bark cloth is still used and is an excellent clothing material; tumu bark being the most commonly used. However, today both men and women obtain cheap cotton material from traders and with it fashion their clothes. No undergarments are worn. In former times gala costumes were worn at festivals; today the chiefs or head men will wear old coats obtained from foreign residents. Many Indian men buy hats, especially straw ones *(sombrero, sumruru, sumuru, trahat, tarahat)*. Women occasionally wear these hats, which constitute to them an ornament. Some Indians in villages wear footgear but this is rare. Most of them go barefoot. The washing of clothes is the women's work and it is done by beating the garments at river banks with wooden clubs *(tamtam)* and the use of soap made from the leaves and fruits of a small bushy tree *(Sapindus saponaria* L.).

In a previous report by Conzemius[1] it was stated that the black and red paint was applied to the skin as an ornament. This was in 1931; today this process is rarely executed although some still apply a reddish pigment (varying from yellow to brown) in order to protect against insects or the chapping effects of weather. The pigment is derived from the seeds of a shrub called annato (Spanish: *achote, achiote,* or *bija)* or rocour *(Bixa orellana L.)* The seeds are removed from the capsule and placed in boiling water. The red waxy material which separates is collected and coagulates when mixed with the leaves of the *tisnat* tree. It is usually mixed with one of the native vegetable oils prior to use. Black paint derived from tree gums are used by the Sumu as well as colored clays. In fact, colored clays have gained considerable favor during these later years.

Tattoo is rarely seen among the Río Coco inhabitants, even though it was commonly used. It is achieved by the simple method of puncturing the skin with steel needles and the application of gun powder into the incisions. Today necklaces and other decorations are rarely seen. Bead and shell necklaces were observed only on a few persons in the upper Coco River. In general one sees a few trinkets used which were obtained from traders.

The men cut their hair short and some of the tribal elders leave a lock of it just back of the crown of the head. The women have long hair except in front where it is common custom to cut just above the eyebrows. This prevents the hair from entering the eyes. Both sexes devote much care to the hair and oil it frequently. The oil *(batana)* is obtained from the seeds of the oil palm *(Elaeis melanoccoca)* and is mixed with rather potent perfumes obtained from traders. From these traders they also obtain inexpensive combs and brushes.

Although body deformation was carried out by Sumu especially

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304 with reference to the head, a custom which had not been practiced by the Miskito. It is no longer performed by the Sumu during the present day.

621 There is no trace of any division in clans or exogamic kinship
624 groups. Before the conquest, the Miskito were not ruled by supreme chiefs, but in time of war the elders would chose some young warrior, noted for prowess, to guide the activities of the group. Generally, though, they were not a warlike people. Hereditary chiefs were introduced by the British and the ruler became despotic in activity. His orders would be carried out by quarter masters *(kwatmas)* or by other members of his staff. Foreign traders extended gifts to the Chief (King) for trading privileges and the Indians rendered assistance and taxes. However, the Indians in the interior paid but little attention to this hierarchy. Today there are village chiefs who guide the civic affairs of the community on what appears to be a democratic basis. Decisions are made as a result of council meetings where considerable discussion may take place.

648 The governments of the two republics, Honduras and Nicaragua, have territorial representatives known as comandantes and these are *Ladinos* (see Appendix B). The comandante may have other *Ladinos* on his staff or as is often the case works in close collaboration with the traders. In the upper Coco River the comandante is stationed at San Carlos. He patrols the area, listens to complaints and his decisions are autocratic. He is in military uniform and his status is one of army discipline. The various companies, i. e., fruit enterprises, rubber development agencies, etc., have many *Ladino* foremen who work in close harmony with the comandante. From the Indian point of view considerable friction exists between himself and the government representative. Since the Indians have no recourse with the Central Government, the jurisdiction of their problems rests with the territorial representative. The Indian complains that there is misappropriation of funds and that traders take endless advantage of them. Regardless of right or wrong, conflict exists and as such it is probably due to the lack of peoples' representation in territorial jurisdiction. Government educa-
[87] tion is at minimum, the various religious missions have generally per-
[564] formed this service to the better satisfaction of the Indians. The Indians live with great equality, there appears to be no rich or poor among them; they do not strive to accumulate wealth.

674 Within the villages themselves government takes place with the
626 elders guided by a chief. A thief is compelled to restore stolen property and an adulterer pays a fine of a gun or a cow. Stealing is rare, except in the more urban areas and adultery is uncovered usually as a result

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of quarrel between two women. The fact remains that very little wrong-doing exists among the Miskito since once a wrongdoer is found out he loses the respect of his community and usually moves to another locality. It a debtor refuses to pay or refund an object or money borrowed, the creditor informes the village of this fact and he can go to the plantation of the debtor and pay himself in provisions without risk. Such pressure usually causes the debtor to make goods his debt.

In rare cases today poisoning is used to exterminate an enemy. This is accomplished by the use of poisonous extracts from plants, alligator gall, or cyanide stolen from the mines. If, however, an Indian shoots his enemy, he must likewise follow him to death. In certain cases, if an Indian has been insulted and cannot collect payment, he commits suicide, wherepon the offender must do the same. In most instances the threat in itself brings apology and payment. In general there is little crime among the Miskito.

The Indians show great reserve, are relatively silent, honest and generally reliable. Stinginess is considered the worst vice and foreigners who bestow gifts are known as good men. They are not quarrelsome. Recent contacts with foreigners has increased their shrewdness and they are less shy than they were years ago.

Members of the family address each other according to sex and relation, such as mother, father, daughter, brother, etc. Each has a name given for some peculiarity. Thus, an infant receives no name until some characteristic is noted.

The mentioning of a deceased person's name is taboo and is a direct insult to refer to the person in the presence of relatives. Husband and wife call each other *mayi*, my consort; before a child is born to them he calls her *kika*, girl, while she calls him *wahma*, young man. After a child is born they often call each other *luhpi yapti*, my child's mother, and *luhpi aisa*, my child's father. *Mahma* or *masa* are used to address a son or brother, whereas *kika* or *misis* refer to daughter or sister. Old men and women are called *dama*, grandfather, and *kuka*, grandmother. The common form of salutation is *naksa* and occasionally *nahki sma* (how are you?) The other replies *aiñwa sna* (I am well). When they take leave the expression is *aisabi* (we will speak again).

DWELLINGS

The villages *(tuwan)* are located chiefly on the banks of waterways, rivers and lagoons. The reason for this may be twofold. First the waterways form the chief source of transportation by boat and secondly agriculture and wild fruits can be developed and secured near

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361 streams. The villages and their populations were studied from Bilwas Karma to San Carlos. (See map.) The villages themselves are perched up high on the banks so that floods will not carry them away.

342 Once a house site has been determined the Indians clear the bush and all large trees, that may endanger the house in case of storms, are felled. The house is usually of rectangular design. Four posts or more are used to hold up a sharp sloping thatched palm leaf roof *(bahna)*. In many houses these roofs extend to about five feet off the ground. The posts are usually of ironwood. Several varieties are used for thatching. [824] such as the *cohune (Attalea cohune)*, *skomphora*, *cola de gallo* or *suita (Calyptrogyne sarapiquensis)* and *caña danta (Geonoma* sp.). These palm leaves may last from for to five years as a roof. Although many Indians use nails today, lianas are still used to bind these structures together. The sides of the houses may be made of split bamboo or boards. Most houses have a sort of loft *(tint)* immediately beneath the roof. It is formed by laying split bamboo or boards across the beams and is reached with the use of a ladder. Various forms of bamboo wattlework may make up the interior walls. Most of the dwellings seen have the floor elevated from the ground at a distance of three to four feet. Thus the houses appear to be set on a series of stilts.

Formerly long communal houses or multiple family houses were used by tribes. Today this practice is abandoned and the family type house is what is found. It must be noted, however, that although many houses are raised from the ground, one occasionally encounters a more primitive dwelling where the family live directly on the ground clay with just a low overhanging roof for protection. But this process can only serve as a temporary shelter since the torrential rains would quickly wash away the household effects.

352 Iron stoves for cooking are common in most houses and in some cases [343] the stove is in a separate house (cookhouse). Many old crates, wooden 354 boxes, and bamboo devices are used for tables and chairs. Beds are made of split bamboo and are raised on posts two to three feet from the floor. Recently hammocks have become popular in the area. They may be purchased from the traders or hand made with cotton, tree bark or Bromelia fibers. Small hammocks are used for children.

[373] Pine wood torches are used for illumination at night and in some cases fiber clusters are impregnated with oils or waxes and lit up. Under the roof the fishing, hunting and agricultural implements are kept.

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TOOLS

Before the conquest the Miskito had very few tools and as has been pointed out by Conzemius[1] these Indians were living in a wood age rather than a stone age. Today the common tools in use are noted in the order of their importance. The machete *(ispara)*, a heavy knife varying from one to two feet in length is the most commonly used tool. It can be used for almost any purpose from clearing bush to ligging postholes. It can also be used as a weapon of defense as well as for cutting and slicing food. Second to the machete is the ax *(asa)* which is used for chopping trees and preparing timber. These axes are made of metal and stone *(alwani mahbra)*. Adzes *(ats)* are today in common use for the making of boats and other objects of wood. With the exception of the stone ax both the machete and the adze are of post Colombian origin.[1] Hoes have been introduced in the last century and these are used primarily for clearing weeds. A variety of knives *(skiro, kisuro)* are seen in all households and used not only to cut with for eating purposes as well.

DIVISION OF WORK

The husband prepares the patch of forest for the plantation. He cuts down the trees and clears the ground by fire. However, the major part of planting, weeding, and taking in the crop is left to the wife. The manufacture of hunting and fishing implements is the man's job. Fishing, however, is carried out by both men and women. The building of canoes is the man's work although women sometimes assist him in this arduous work. Men will cut trees for firewood but the women have to fetch the lengths of timber cut by the men.

It is customary for women to carry heavy loads but the men occasionally do. Heavy loads are placed on the back by the use of a carrying strap *(bombador)*. Many of the women carry loads on their heads.

All the domestic industries such as weaving, spinning, cooking, etc., are female occupations. Tailoring, however, is shared by both the men and the women. The barbecuing of the chase is the only cooking men indulge in.

FUNCTIONAL ENTERPRISE

Interchange of commodities is commonly effected by barter but today there is an ever increasing use of currency (córdoba). Trading is carried out with traders and the Indians in many instances exchange

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cattle and other goods for objects of cheap manufacture. Yet these objects may be of real intrinsic value to the Indians and under such circumstances it is difficult to judge with fairness. However, in the larger settlements Indians have learned the true cost of materials and considerable agitation occurs in trading. Payment for services performed in isolated communities can be accomplished by the use of such commodities as salt and tobacco. In fact, many will prefer these to actual money: in the more remote areas money per se is meaningless and payment is performed with gifts.

These days there is an ever increasing want of objects from the outside world. The items most desired are salt, machetes, axes, knives, adzes, hoes, iron cooking pots, stoves, fish hooks, files, shotguns, ammunition, cotton goods, ribbons, blue dungarees, looking glasses, combs and tobacco. Cereal grains and flour are also desired.

The enterprise of the Indian today is centered mainly around the creation of useful objects. Such objects, therefore, are often used for exchange purposes. Stone work is limited to the manufacture of crude metates or maize grinders (walpa-akbaya) which are used for grinding maize. In the northern part of the Miskito coast a coarse brownish cloth is pounded from the inner bark of a tree closely resembling the rubber trees (*Castilla* sp.). The cloth as well as the tree is referred to as *tunu* or *tikam*. The bark cloth is made into sheets or blankets for bed use or into loin cloths (*palpura*). This cloth is of high value. Pottery once a valuable commodity to these Indians is not alonger made.

Today the main enterprise for the Miskito Indians for barter, exchange or payment are as follows: rubber collecting, banana agriculture, boat making, mine working, cattle and pig raising, general work on rivers, fur from wild animals, and general labor. However, it is to be noted that the Indian could and does in most instances subsist on his immediate environment.

VEGETABLE FOODS

Agriculture is not highly developed on the Mosquito coast, because the many plant-destroying insects limit the process of cultivable products, and the bush springs up early after the ground has been cleared. Thus after two or three crops have been obtained from a plantation (*kanana*), a variety of weedy looking shrubs and grass, which make cultivation difficult, gets a hold on the land. The Indian then does not consider it worthwhile to undertake the labor needed to keep the ground clear but prefers to set up a new plantation (*insla*) by cutting down a patch of usable forest.

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The most important fruit plant of the Miskito is the banana *(sik-sa)*. It is not indigenous to America but was brought by the Spaniards. The banana tree produces one good crop and the new shoots appearing at its base are transplanted for another crop. Of the great variety of bananas and plantains grown by the Indians the most common is the *Gros Michel*. Sweet cassava *(yauhra)* is the staple food for the coastal Miskito and it is also cultivated by those living inland. Eddoes or tanias *(dusua)* which are known also by the name "Coco", are cultivated for their edible tubers.

A semiwild yam and sweet potato *(tawa)* is eaten; pumpkins and squashes are also grown to some extent. Maize *(aya)* or Indian corn, which forms a staple food practically all over Central America, is sparsely and occasionally cultivated by the Miskito. When grown the corn is stored by hanging it under a roof over a low fire and smoked in order to prevent molding. Red or black beans *(snek)* are grown to a very small extent by the Miskito. Rice has been recently introduced. The grains of rice are heavy and rounded and differ from our native wild rice or those kinds ordinarily found in the tropics. The pejibaye *(supa)* is cultivated for its edible fruit; the Central American name for this plant appears to be taken from the Arawak language of Haiti. It is not a native plant in this area, so that it is found only in cultivated state and deserted palms indicate former village sites. The coconut palm *(kaya)* is found in a semiwild state. The Indians drink the juice of the nut, eat the tender kernel, and extract the oil. Oil is obtained by skimming the top of a boiling decoction of kernels and water.

Sugar cane *(kayu)* brought by the Spaniards during the sixteenth century is grown by the Miskito. They have a mill to extract the juice but have not learned to prepare sugar from it. They drink the fresh juice of the plant or allow it to ferment; sometimes it is boiled into a brown syrup which on cooling partially hardens to form a sort of brown sugar. Cacao which is indigenous, is sometimes cultivated but the pods are usually obtained from wild trees.

The most common native fruit trees are pineapples *(pihto)*, papaws or papayas *(twas)*, avocados or alligator pears *(sikya)*, soursops *(dwarsop)*, cashews *(kasan)* and plums *(poims)*. The common fruit *(dwarsop)*, cashews *(kasan)* and plums *(ploms)*. The common fruit dock, grapefruit, mangoes, breadfruit, tamarind, and rose apples. A few bushes of cotton, chili peppers and annato are found near every lodge.

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MEAT FOODS

226 . A very large share of food is obtained from the sea, the lagoons, and the rivers. Larger fish are caught by throwing a spear or javelin, smaller ones with hooks or nets. Previous to the introduction of steel, the Indians fashioned their spear heads from bamboo, which was easily cut into barbs. A cord is attached to the point whereas the shaft is a solid light wood. With this device they spear the carp-like snook and the tarpon. At night fish are attracted by the use of a pitch pine torch and are also speared; turtles are harpooned. Fish are sometimes caught by "poisoning" the water. For this purpose the Indians utilize several vines; usually one which has been identified as *Seriania inebrians*. The vine is crushed with flat stones to release the poisonous milky juice. A creek is temporarily dammed and at some distance above the dam the crushed plant is thrown into de water, the fish are quickly paralyzed and are then caught by the Indians. Large fish are easily harpooned when in this condition. Smaller fish are allowed to float away and recover when they reach unpolluted water. Bows and arrows are rarely used today for fishing purposes but near mining centers fish are often dynamited; this process is to be condemned since it destroys the majority of the smaller fish.

[225] The tails of young alligators and crocodiles are occasionally eaten. Lobsters, crabs, and mollusks form an important item of food. In general, the rivers and lagoons afford an ever present, easily obtainable source of food.

224 With muzzle loading and other equally out-of-date shotguns, the Indians hunt game. Spears, bows, and arrows are occasionally used but the blowgun is no longer used. Game is found in abundance along the margins of the rivers. Deer, Peccary, spider monkey and capuchin monkey, tapir, lizards and a variety of birds, including parrots, red-spoonbills, curasows, mountain hens, quail, partridge, pigeons and a number of wild ducks, are used for food. In addition to the wild game, the Indians raise and eat some domestic cattle, pigs and chikens. There is no lack of meat of one form of another. It is often preserved by drying and smoking it for several days over a dull fire, since the humidity is too high for sun drying. Salt is used sparingly by the Indians.

FOOD PREPARATION AND CONSUMPTION

373 . Fire is a necessity for cooking, for without it the Indians would have to subsist on raw foods. Fire is produced by twirling a hardwood stick in a notch of wild cane. When smoke appears a piece of wild

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cotton fluff is placed in the notch and the twirling continued. Several 373
fragments of the cotton begin to glow and these are fanned into flame. Today, many Indians use matches but the primitive method of making fire is still used to a great extent. Many of these fires may have been started a generation or more ago. They are tended or kept burning in iron or stone cooking ovens within the houses.

Many of the Miskito use bamboo tongs or tweezers to pull roasted 415
plantains, cassava, and other foods out of the hot ashes. The Miskitos use large wooden mortars *(uno, no)* and hard wooden pestles *(una, mihta)* to pound grains and fruits. The pestle is single headed and tapers toward the handle end. The Sumu Indians on the other hand use a metate and mealing stone for grinding maize and cacao. Light iron tripod post *(dikwa)* are found in every household, and have replaced earthen vessels for cooking purposes. Large calabashes with a small hole in the apex, just large enough to insert a finger, are the common water canteens *(kahmuntara)*. Segments of a large species of bamboo are also used to haul water in certain areas. They are made from a section of the bamboo stem cut so that a nodal septum serves as a bottom. The stem may be cut off immediately below the next septum or it may be cut outside of each septum to convert it into a small barrel. A hole is then drilled for filling and a plug inserted.

Fermented beverages are stored in large earthen vessels *(sumi)*. Plates, cups and glasses are made from the calabash *(kalmi)* fruit, which is cut and the soft watery pulp and seeds removed. Square, round, or oval shaped bowls are sometimes made of mahogany and other woods, but calabash bowls seem to be preferred. A variety of wooden spoons, pat sticks, and stirring sticks are also used. A primitive sugar mill *(tranko)* is employed to squeeze the juice from sugar cane.

It has been observed that the Miskito Indian has an enormous ap- 264
petite. At some meals he may take as many as a dozen helpings. On the other hand he may go days with hardly any food at all, specially during inclement weather, or during a hunt or a long travel. Generally, the women do the cooking, the men only on trips away from home. No regularity is observed in eating, most of the Indians eating whenever they are hungry or after hunting. They usually have one meal in the early morning and one at night before retiring. There is no midday meal. When a meal is ready the grownup men are served first with the best and largest shares. A calabash of soup or stew is usually served first. Salt if available is eaten separately. The women and children eat together. Indians rarely speak during a meal, and a visitor is never questioned while he too should remain in silence, since to do otherwise would be a breach of etiquette.

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252 Meat and fish are either boiled in water or roasted in hot ashes.
262 The favorite meats are red monkey and white lipped peccary. Birds eggs are eaten, even if partially rotten but the eggs of domestic fowls are seldom used. Bananas are cooked in many ways depending to a great extent on the degree of ripeness. Fish are wrapped in bajagua leaves and roasted or fried in coconut oil.

Vegetables such as cassava, sweet potatoes, tania, yaws, green bananas and plantains are either boiled in water or placed with the meat for roasting. The pith or "cabbage" or various palms are also cooked and eaten and other wild fruits are used raw when in season A sort of bread is made from time to time by grinding dry maize in a metate and adding water. The mixture is then wrapped in bijagua leaves and allowed to stand for several days during which time it ferments. It is then baked in embers.

A sort of ensilage called *bisbaya* is made by the Indians and consists chiefly of green bananas, plantains, and pejivales. These are peeled and buried in the ground, covered layer by layer with bijagua leaves and the ensilage is not uncovered until required for food. The fruit retains its whitish natural color and turns black only after exposure to air. These food supply units have been known to last for years. Bisbaya may be consumed as a beverage after being toiled with water or it may be baked in leaves as a sort or bread. The fruit of the pejivalle palm is treated in a similar manner.

252 Various species of pungent small wild peppers are used with food
263 as a seasoning. The peppers are mashed with lime juice and little salt to make a sauce which is stored in containers and used at meals to replace salt. Besides the use of peppersauce the ashes of burned palms are often used to replace salt and in fact have a high salty flavor. Vanilla is used to flavor a drink prepared from cacao and maize.

262 The eating of earth and charcoal (geophagia) is common among women and children and the exact physiological effect is unknown. Milk from domestic cows is common and is usually consumed as it sours or converted into a cheese.

The Indians are fond of foods that have soured or spoiled a little
[273] and often allow many decoctions to ferment; distilled liquors, however, are unknown.

221 *Seasonal intake of foods.* Meat, fish, fowl, cheese and milk are con-
262 sumed daily throughout the entire year but consumption of vegetables and fruits is seasonal.

January	*Aladi cati. Inupu cati:* bastard cedar flowering time. Citrus fruits in quantity, avocadoes, melons, nuts.

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February	*Cauwa cati, isla cati:* tortoise time, iswilly lizard time. Few citrus fruits, coconuts or vegetables.
March	*Cacamuk cati:* iguana season. Few green vegetables or fruits.
April	*Willi wauica cati:* male turtle time. Coconuts, very few vegetables, few bananas.
May	*Willi Mayrhen cati:* female turtle time. More bananas, plantains and coconuts.
June	*Li cati:* rain month. Same as May.
July	*Pastara cati:* high wind time. Same as May, a few more greens, bananas.
August	*Sicla cati; wis cati:* ? Few citrus fruits, more greens, bananas.
September	*Wis cati:* wis month.
October	*Sauhs cati, prarhi cati:* south wind month, hurricane time. Food consumption depends to a great extent on the weather. Wild fruits, citrus fruits.
November	*Yahibra cati:* north wind time. Citrus fruits, wild fruits.
December	*Krismas cati:* Christmas month. Fewer vegetables and fruits consumed.

During May, June and July no greens of any kind are available; this is true also during late December and January. Meat consumption remains fairly constant.

Average meat intake per day (June)	960 grams.
Other fruits and foods (June)	400 grams.

The above was the approximate daily consumption of my head boatman, Ramón. Others ate a little more or a little less, but the proportion was about the same. Apparently, members of most families consume about the equal amounts of meats and vegetables as he did. On the other hand, following a hunt, the meat consumption increases significantly and sometimes an entire animal is eaten at one sitting. Be it noted that meat is usually secured from hunting or fishing. This 262
is somewhat striking when one observes the large numbers of turkeys 231
among the families. It is assumed that as such these birds would be eaten frequently but instead they are consumed rarely; they are household pets. To some extent this is true of chickens. Pigs, on the other hand, are more frequently eaten; they require little care and in general forage for themselves. Cowmeat, steermeat, heifer meat, etc., is obtained from the occasional slaughter of domestic cattle. The latter are plentiful.

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262 The Indians also secure honey from wild honey bees. In the Coco
[223] territory there are various species of stingless bees *(Meliponidae)*. The honey cells are circular and the honey is yellow and slightly acid in taste, it does not crystallize when kept for sometime. Previous to the introduction of sugar cane the honey was used to sweeten food.

The most important food of the Miskito Indian is the banana, even though it is not indigenous to America. As such this is one of the few examples where a food originally foreign to a people was immediately accepted an chronically utilized. On the other hand the use of cereals so common throughout the Americas, is infrequent. The reason for this is that cereals are difficult to grow in this territory. The numerous insects which attack certain types of vegetable or plant life restricts agricultural enterprise. Furthermore there appears to be no need of cereals in the diet. Beans have recently been introduced and in some communities they have been raised for eating purposes.

Oils are easily prepared from coconuts or varieties of nuts. These are crushed and placed in boiling water, and in due course the oil rises to the surface and is skimmed off.

262 It can be said that the Miskito Indians living as they are, unmo-
177 lested, by the banks of rivers and streams secure enough wild fruits, vegetables, fish and game to adequately supply the yearly food. To this is added small agricultural projects of their own, such as banana plantations, citrus fruits, etc. When these Indians become sequestered in larger villages or are removed from their community to work for mines, rubber collection, or as laborers for fruit companies, the dietary deteriorates. To secure food under these new circumstances they need money, a substance which is easily expendable and does not represent a material which may be needed in the future. The Rubber Development Corporation has had in many instances fed laborers on foreign foods which have not always agreed with or been agreeable to workers.

NUTRITIONAL EVALUATION OF THE DIET

121 The evaluation of the nutritional status of individuals from any single examination of their diet is difficult if not impossible. There are widely divergent views regarding the needs of the body, as to the extent and character of the food requirements, of the relative merits of various foods and as to the degree and frequency of intake of the nutritional components. A survey of dietary intakes will often make one suspect a deficiency and may warn the investigator what to seek for In the end clinical appraisal is the only satisfactory method. There is

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today suficient evidence[36] to show that potential deficiency disease, latent deficiency disease and subclinical deficiency disease are unwarranted definitionally and that only the frank clinical manifestations are satisfactory for a diagnosis. Furthermore, the certain milder symptoms often ascribed to deficiency of a nutrient are more often related to another cause.[37] Thus, gingivitis has resulted, experimentally, from a deficiency of vitamin A,[38] of vitamin D,[39] of vitamin M,[40] of nicotinic acid[41] as well as ascorbic acid. Furthermore, most cases of gingivitis are unrelated to vitamin deficiency,[42], [43], [44] and in most instances does not respond to vitamin C therapy. Glossitis, furthermore, may be due to numerous causes other than nicotinic acid deficiency; cases with Bitot's spots are in most instances resistant to vitamin A therapy[45] and many exhibit vitamin A plasma levels usually encountered in healthy individuals.[46] Berliner[47] has questioned the diagnosis of xerosis conjunctivae as depicted by Kruse;[48] keratitis and corneal invasion found in rats on riboflavin free diets[49] does not occur in monkeys and in humans the lesions seen are more often due to other causes.[50] It must

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[46] Darby, W. J. (unpublished observations, 1945).

[47] Berliner, M. L. Regarding early detection of avitaminosis A by gross or biomicroscopic examination of conjunctiva. Amer. Jour. Ophthal. 1942, *24*, 302-308.

[48] Kruse, H. D. Ocular manifestations of avitaminosis A. Dis. Eye, Ear, Nose and Throat. 1941. *1*, 272-287.

[49] Bessey, A. O., and Wolbach, S. B. Riboflavin deficiency in the rat. Jour. Expl. Med. 1939. *69*, 1

[50] Darby, W. J., and Milam, D. F. (1945, in press).

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121 be concluded that there exists no specific tissue alteration which alone may be considered pathognomonic of a single deficiency state: the deficiency must be characterized by all of the clinical signs and symptoms proven to result from a nutritional defect.

116 In regard to the Miskito Indians no cases of vitamin deficiency were observed, either by the use of the unproven criteria advocated by Kruse[51] or by the strict clinical evaluation of the subject. Marasmus and malnutrition were observed in infants suffering from diarrhoea, dysentery, or who were abandoned and deprived of food. But other than this finding, little can be said in favor of malnutrition. This becomes obvious in view of the foods these people consume: fruits in season and meats would militate against malnutrition. The people are generally robust and well built regardless of their food habits and while they eat only when hungry, without regularity, it must be admitted that such a method cannot be nutritionally unsound. At Waspook where large quantities of meat and vegetables are consumed the year round, eye lesions often ascribed to ariboflavinosis were commn but the local trader would generally assure a cure by selling dark glasses. The eye conditions were most bothersome during the dry seasons and less so during the rainy season.

The brief study of the dietary habits show that the protein intake from animal food is high, that from legumes relatively low. It has been estimated that the Miskito Indian consumes from 150 to 300 gms. daily of protein, 150 gms. of fat and 200 gms. of carbohydrate; these figures vary somewhat but in general the relationship is about the same. Thus the caloric intake is from 2000-3000 calories daily. These are, of course, average figures determined over a period of time, since the Indian often goes withouh a significant food intake for periods of several days to a week. Except for the fact that the diet of the children may be somewhat low in calcium, there appears to be no dietary deficiencies among these people.

Some of the commonly consumed foods were analyzed and the results are as follows:

[51] Kruse, H. D. Handbook of Nutrition; medical evaluation of nutrional status. Jour. Amer. Med. Assoc. 1943, 20, 584.

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CERTAIN SPECIFIC NUTRITIONAL FACTORS IN COMMON FOODS 146
(Per 100 Grams portion)

	Salt Na Cl. gms.	*Calcium* gms.	*Iron* gms.	*Thiamine* mg.	*Niacin* mg.	*Ascorbic Acid* mg.
Fish:						
Snook	.301	.016	.0016	.06	3.16	
Bass	.202	.028	.0020	.07	2.10	
Monkey	.112	.010	.0028	.092	4.98	
Parrot	.114	.014	.0020	.09	4.36	
Beef	.120	.017	.0032	.082	5.83	
Coconuts	.192	.020	.0014	.02	.42	
Bananas	.131	.006	Trace	.04	.30	7.0
Avocado	.018	.016	.0010	.05	.80	18.0
Oranges	.009	.024	Trace	.06	.16	52.0
Lemons	.005	.023	Trace	.01	.08	72.0
Grapefruits	?	.020	Trace	.03	.10	64.0
Cheese (semicottage)	?	.164	.002	.04	.08	

The intakes of salt average between 1-2 gms. daily; iron between 7-14 mg.; calcium from 0.4-0.9 gms.; thiamin from 0.5-1.0 mg., and niacin from 10-20 mg. During January, February, March and April, the ascorbic acid consumption is low, approximately 10-15 mg. a day. From May to July there is a slight increase of about 5 mg. more in the dietary, while from August to December the intakes will be from 150-300 mg. daily due to the high consumption of citrus fruits, the high intake during this period affords sufficient protection of health during the subsequent period under a maintenance regime.

Clinical findings as regards nutrition. Anemia is the most prevalent finding among children of the Coco River Basin, and what is amazing is the way children tolerate rather drastic reductions in hemoglobin content. Admittedly, altitude is no problem in this region so that at least there is no demand for an increased oxygen capacity of the blood. On the other hand it is impossible to differentiate, clinically, between children having a blood hemoglobin content of 8.0 gms., and those with 13.0 gms. per 100 gms. of whole blood. Furthermore, if the anemia is improved by the use of iron salts the parents may or may not note a difference in the child's behaviour, clinically the difference cannot be detected except in rare instances. In the more severe anemias children complain of lassitude, fatigue, restlessness and lack of energy.

The primary cause of anemia is the type of diet used in early infancy. The child is placed at the breast as soon after birth as possible and is fed whenever it cries. Irregularity in feeding seems to be of no bother to the parents. However, during teething the mother automatically reduces the number of times a day a child is placed at breast since teeth

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146 853 irritate the nipple and causes discomfort to the mother. It is at this point that considerable supplementary feeding is introduced. It is of interest to note that the teeth begin to make their appearance at about the fourth to fifth month in contrast to the average of six to seven months in the United States. The fact that iron reserves are exhausted at about the third month and that supplemental feeding occurs shortly thereafter is a curious coincidence favoring the child.

[827] The Indians believe that food consumed by the mother produces milk and for this reason the mothers eat often and large quantities of food. The children are fed bananas early in life and even if the iron intake from milk supplemented with bananas amounts to 4 mg. a day, it is insufficient to adequately overcome physiological hemoglobin depletion. Theoretically this would soon be made up by foods rich in iron. This in fact is what is attempted by the natives themselves but the anemia is not generally overcome because just as soon as the children begin crawling outdoors form infestation occurs and a relative anemia may be maintained.

146 For practical field use, hemoglobin determinations were carried out using the Sahli equipment and 100 per cent hemoglobin was computed to indicate 15.6 gm. per cent hemoglobin in blood. For purposes of comparison between hemoglobin levels in Guatemala, Yucatán[82] and the Coco territory of Nicaragua, the averages represented:

Guatemalans (691 cases, Shattuck)	73.3 per cent
Yucatecans (2037 cases, Saunders)	71.9 per cent
(1261 cases, Shattuck)	70.6 per cent
Coco River (100 infants, Pijoán)	55.0 per cent

It is admitted that the method of hemoglobin estimation varied, i, e., Shattuck used the Tellquist method, whereas the Sahli method was used in the Coco study. Regardless of this fact, there was less altitude in the Coco Basin to provoke hemoglobin increases and secondly the incidence of insidious disease seemed greater.

Hemoglobin values in 100 infants (2-3 months old) in Zapuca and Waspam, Coco Basin, Nicaragua.

Number of Infants	*Hemoglobin value*
29	60-70 per cent
48	50-60 per cent
23	40-50 per cent

Another point of difference between this study and the others is that the findings by Shattuck was fairly representative of his territory

[82] Shattuck, G. C. A Medical Survey of Guatemala. Carnegie Institution of Washington. 1938.

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in regards to age groups whereas this one concerned itself with infants 146
where anemia was to be expected. Furthermore Shattuck was able to exclude malaria as a cause of anemia.

Blood smears were examined and the significant findings were a slight achromia and variation in size and shape of the red cells, and microcytosis characteristic of chronic hypochromic microcytic anemia commonly associated with iron deficiency in the body.[51] So far then in infants and early childhood the prevalent deficiency is an iron lack which was found to be so not necessarily on clinical evidence but on laboratory investigation. .

Hypochromic anemia. The relatively low iron content of milk (1.8-2.3 mg. 1 liter Fe) [52] accounts for the presence of anemia in early infancy and subsequently a diet, early in life, not rich in iron may not overcome the depleted iron reserves. To this is added the anemia sus- 146
tained by the effects of infection and intestinal parasitism. Since the 164
more severe anemias occur in those subjects with hookworm disease an iron balance study was undertaken.

Balance study of four subjects with Necator Americanus infestation: Since the demonstration by Stiles,[54] Harris, [55] and others, that hookworm infestation in the United States in associated with anemia, the relationship of cause and effect the syndrome has received attention

Recently Rhoads, Castle, Payne and Lawson[56] have advanced the view that the anemia resulting from hookworm infestation is due to blood loss through the bowel. This is based on the fact that the worms with their hooks cause minute hemorrhages in the bowel wall, but they have stated as have other observers[57], [58] that although there is a slow hemapoietic response to iron therapy during infestation a dramatic response to treatment occurs only when it is administered after the removal of the worms. The assumption that this is a blood loss anemia

[53] Peterson, W. H., and Elvehjen, C. A. The Iron Content of Plant and Animal Foods. Jour. Nutrition, 1931, *4*, 419.

[54] Stiles, C. W. Report upon the prevalence and geographic distribution of hookworm disease. U. S. Govt. Print. Off., U. S. Public Health Service Hyg. Lab. Bull., 1903, *10*.

[55] Harris, H. F. Ankylostomiasis, the most common of the serious diseases of the southern part of the United States. Amer. Med. 1902, *4*, 776.

[56] Rhoads, C. P., Castle, W. B., Payne, J. C., and Lawson, H. A. Observations on the etiology and treatment of anemia associated with hookworm infection in Puerto Rico. Medicine, 1934, *13*, 317.

[57] Rotter, W. Ueber die histologischen Veränderungen des Dunndarms bei Ankylostomiasis. Virchows Arch. of path. Anat. 1931, *280*, 587.

[58] Rhoads, C. P., and Castle, W. B. Observations on the etiology and treatment of the anemia of hookworm disease in Porto Rico. Jour. Clin. Invest. 1932, *11*, 809.

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is based on the blood picture, bone marrow examination and on the fact that the effect of iron therapy was moderate until after the removal of the worms. The fact that live extract exerted no particular effect was interpreted by Rhoads and his associates to support their view.

The assumption that blood loss is the cause hookworm anemia is a good one since it is obvious that the worm draws through its gastro-intestinal tract a fairly copious amount of blood. In fact, much of the blood may pass through the worm in an unused condition. On the other hand it is of interest to note that the degree of anemia and the number of worms present in an individual cannot be correlated.[59], [60] Actually it has been found that a small number of parasites can cause a profound anemia. Whipple,[61] furthermore, has found weak hemolytic factors in hookworms which has suggested the chronic effects of a hemolysin.

The morphological characteristics of the blood cells in hookworm anemia are not those found in hemolytic jaundice. There is besides this consideration the report of De Langen[62] which expresses the view that hookworms secrete a substance toxic to bone marrow. It may be that a variety of factors aside from blood loss exist which are responsible for the anemia. So far no one has attempted to determine iron utilization in subjects with hookworm infestation, a feat which today could be studied to advantage with radio active iron. Our studies, however, were carried out using the classical method of iron balance in which certain errors may occur.

The iron balance was performed in four subjects with hookworm infestation. The procedure used was that described by Farrar[63] and the iron assays of food and feces were performed by the method of Pijoan and Elkin.[51] The only hematological inquiry was the hemoglobin determination in order to ascertain the response to various intakes of iron. The subjects were boys, two of them of 8 years of age, one of 10 years and another of 12 years. As far as could be ascertained all

[59] Smillie, W. G. Studies on Hookworm infection in Brazil. Rockefeller Inst. Monograph, 1922, *17*, 46.

[60] Rosenblum, M. B., and Malkowa, M. N. Zur Charakteristik der Anaemia bei Anchylostoma duodenale. Folia Haematol., 1928, *37*, 197.

[61] Whipple, G. H. The presence of a weak hemoglobin in the hookworm and its relation to the anemia of Uncinariasis. J. Expl. Med., 1909, *11*, 331.

[62] De Langen, C. D. Contributions to the toxic origin of the Anaemia and other symptoms with Ankylostomiasis. Trns. 5th Biennial for East. Assn. Trop. Med. London, 1924.

[63] Farrar, G. E. Jr. The determination of iron in biological material. Jour. Biol. Chem., 1935, *110*, 683.

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of them had untreated hookworm infestation of some duration. There was no method at our disposal to accurately determine the degree of infestation. The diet consisted chiefly of milk, bread, cheese, avocado, banan, vitamins and eventually ferrous sulfate supplements. The results are expressed in the following tables.

SUBJECT I

	Intake mg.	*Feces Fe Output* mg.	*Balance* mg.	*Hbg.* %	*Occult Blood in Stools*
1	7.31	7.40	— 0.09	7.4 gms.	None
2	7.42	7.40	— 0.02		None
3	7.21	7.40	— 0.19		None
4	7.46	7.50	— 0.04	7.38 gms.	None
5	7.33	7.31	+ 0.02		None
6	7.37	(*)			
7	7.56	7.49	+ 0.04		Trace
8	8.22	8.31	— 0.09		Trace
9	8.41	8.39	+ 0.02		None
10	8.30	8.30	———		
11	8.60	8.75	— 0.15		Trace
12	8.75	8.62	+ 0.13		None
13	8.80	(*)			
14	8.20	8.31	— 0.11	7.38 gms.	None
15	8.36	8.30	+ 0.06		None
16	8.41	8.46	— 0.05	7.36 gms.	

Total Balance in 16 days — 0.51

* Specimens lost.

SUBJECT II

	Intake mg.	*Feces Fe Output* mg.	*Balance* mg.	*Hbg.* %	*Occult Blood in Stools*
1	11.15	11.15	———		
2	11.20	11.21	— 0.01	6.0 gms.	None
3	10.40	10.38	+ 0.02		Trace
4	10.81	10.58	+ 0.23		None
5	9.68	9.72	— 0.14		None
6	10.41	10.46	— 0.05	5.8 gms.	Trace
7	10.28	10.30	— 0.02		None
8	9.24	9.26	— 0.02		Trace
9	9.82	9.79	+ 0.03		None
10	10.56	10.58	— 0.02		None
11	10.62	10.62	———		Trace

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12	10.84	10.83	+0.01	6.0 gms.	Trace
13	11.36	11.36	——		None
14	11.42	11.43	−0.01		None
15	11.41	11.42	−0.01		None
16	13.64	13.63	+0.01	6.12 gms.	None

Total Output Equals Intake Neg. Balance.

SUBJECT III

	Intake mg.	*Feces Fe Output* mg.	*Balance* mg.	*Hbg.* %	*Occult Blood in Stools*
1	18.75	18.76	−0.01	5.16 gms.	None
2	22.43	21.06	+0.35		None
3	19.35	19.37	−0.02		Trace
4	20.36	20.36	——		None
5	21.10	21.08	+0.02		None
6	20.34	20.36	−0.02		Trace
7	22.10	22.09	+0.01		None
8	21.15	20.15	——		None
9	18.98	18.96	+0.02		None
10	19.26	19.25	+0.01		None
11	19.34	19.34	——		None
12	19.71	20.74	−0.03	5.80 gms.	Trace
13	19.24	19.23	+0.01		None
14	19.49	19.47	+0.02		None
15	20.10	20.10	——		None
16	20.18	20.17	+0.01	6.0 gms.	None
Total Balance			0.38 mg.		
			0.0237 mg. per day		

SUBJECT IV

Supplemental Iron Given (given 75 mg. $FeSO_4$ = 27.5 mg. Fe)

	Intake mg.	*Feces Fe Output* mg.	*Balance* mg.	*Hbg.* %	*Occult Blood in Stools*
1	36.41	36.38	0.03	7.12 gms.	No
2	37.42	37.39	0.03		tests
3	36.30	36.28	0.02		done
4	38.40	38.31	0.09	7.40 gms.	because
5	44.76	43.57	1.19		of
6	45.71	44.65	1.06		high
7	44.84	43.78	1.06	8.0 gms.	iron
8	44.73	43.66	1.07		intake

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9	45.12	43.11	2.01	
10	43.19	42.13	1.06	9.0 gms.
11	39.38	39.30	0.08	
12	38.40	38.31	0.09	
13	37.41	37.32	0.09	10.5 gms.
14	36.64	36.59	0.05	
15	38.52	38.45	0.07	11.5 gms.

Total Intake 9.11 mg. or 0.57 mg. Fe daily.

Since the amount of iron in urine is negligible and would indicate if anything in favor of negative balance no urinary excretion iron assays were performed. It is obvious from our study that a positive but slight (0.0237 mg.) balance is shown when the consumption of iron is in the neighborhood of 18 mg. iron intake a day, but it is known that during early life iron requirements are considerable and the drains upon the iron stores will then be the greatest. Exhaustion of iron stores takes place during the first year of life when the total blood volume is tripled and the total hemoglobin doubled.[84] A low iron intake at this time will bring about a depletion of the iron reserve. At the age when Necator infestation manifests itself the hemoglobin stores are often low or exhausted. It has been calculated by Heath and Patek that the average annual requirement of a 10 year hold child is about 0.152 grams or 0.04 mg. per day of absorbed iron (derived from a positive balance). It is obvious therefore that the iron utilization of 0.0237 mg. per day is quite insufficient, especially when the body stores are depleted. Thus, in Necator infestation more iron is required, and the administration of supplemental iron (75 mg. $FeSO_4 = 27.5$ Mg. Fe) brings about a positive balance where 0.57 mg. Fe are apparently absorbed daily. From subfindings it seems clear that the anemia of hookworm requires treatment with large doses of iron and it has been the clinical experience of others[85] that improvement takes place only with large doses of iron ammonium citrate and ferrous sulfate. On the other hand the hemoglobin increases 1/2 per cent per day if the worms are first removed.[86] These data presented here lead us to conclude that the explanation of anemia based entirely on blood loss from the bowel is an unsatisfactory one. Even though it may contribute to the anemia of Necator infestation, some other mechanism must play a role in sustaining the anemia. Whether the worms secrete a toxin which affects the hemopoietic system or a substance which forms unassimilable iron salts is a matter of conjecture and requires further inquiry. It has been noted that about fifty per cent of subjects with hookworm infes-

[84] Heath, C. W., and Patek, A. J., Jr. Anemia of iron deficiency. Medicine, 1937, *16*, 267.

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146 tation have chronic diarrhoea, some have glossitis,[65] occasionally leu-
164 copenia and lymphocytosis is observed. Reticulocyte counts usually were under 3 per cent and studies on platelets show them to be within normal limits. These findings indicate some unusual process in Necator hypochromic anemia.

Our own assays of the worms themselves reveal an iron content of only 1-2 mg. Fe per kilogram. It seems unlikely therefore that iron consumption by the worm plays a rôle in the anemia.

WORM INFESTATIONS

164 Because the writer is not a helminthologist the classification of
114 intestinal parasites is not a complete one and depended considerably on the aid given him by laboratory assistants. However, certain aspects of the subject are intriguing. Sandground[66] has pointed out that the data dealing with intestinal parasites can be collated in such a way as to throw light on the racial origins of some of the Indians and to bear witness to the invasion of Central American countries by alien races. Von Thering according to Sandground had demonstrated the value of testimony from the world of parasitism as an aid to zoogeography and paleozoology. For instance, in recognizing the close affinities between the tapeworms harbored by marsupials in South America and Australia, Zschokke[67] presented evidence of a phylogenetic relationship in their hosts. Metcalf[68] also demonstrated by studies on opalinid ciliates in Amphibia a genetic relationship between frogs of South America and Australia and brought out new facts which tended to corroborate hypotheses in geography dealing with land masses connecting now isolated continents. Using information on the history of certain infectious diseases, and their prevalence in certain races, Williams[69] used the host-parasite association as a means of studying racial relationships among American Indians.

[65] Ashford, B. K., King, W. W., and Gutiérrez, P. Report of the study and treatment of "anemia" in Porto Rico. Bur. Print. and Supplies, San Juan, 1904.

[66] Sandground, J. H. Consideration of relation of host specificity of helminths and other metazoan parasites to phenomena of age resistance and acquired immunity. Parasitology, 1929, *21*, 227-255.

[67] Zschokke, F. Die Darmcestoden der Amerikanischen Beutelniere. Centralbl. f. Bakteriol. 1904, *36*, 51-62.

[68] Metcalf, M. M. Bull. 120, U. S. Nat. Mus. 1923: Smithsonian Misc. Coll. 1929, *81*, No. 18.

[69] Williams, H. U. The epidemic of the Indian of New England, with remarks on Native American Infections. Johns Hopkins Hosp. Bull. 1909, *20*, 340-349; 1616-1620.

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The solution of ethnological problems by the helminthological approach is not without its difficulties and as such is beyond the scope of this report. On the basis of Sandground's data the prevailing hookworm infection among pure blooded Indians should be *Ancylostoma duodenale* but where Negroes have settled and intermingled the infestation becomes dominantly *Necator americanus*. In the Coco Basin, where hookworms were introduced primarily by negroes, the infestation, as far as our observations permitted, was that of *N. americanus*.

It is of interest to note that onchocerciasis was not found in the Coco Basin even though the writer thought he had found two patients with this disease. The biopsy material was poorly prepared and there was some question as to the identity of the filarial worms. That the diagnosis was probably erroneous was further strengthened by the fact that *Simulium* flies transmitting this disease were not seen. However, the limited observations in searching for the fly were by no means thorough and do not exclude the possibility of their existence or that of the disease. It may be that in years to come when commerce between natives is increased the appearance of onchocerciasis may become an obvious clinical finding.

Cases of Schistosomiasis have been reported from Panama, Costa Rica and Yucatán but none have been reported from Guatemala[70] nor were we able to find any in Central Nicaragua. Even though *S. mansoni* and *S. hematobium* are of Ethiopian origin, the appearance of negroes in the Coco Basin did not introduce the disease and this fact is ascribed to the absence of the species of snails suitable for the larval development of the parasite.

The commonest worm infestations in the Indians of the Coco Basin were *Ascaris lumbricoides* and *Trichuris trichiura*. The former was common in communities which do not possess sanitary facilities and is contracted by ingesting eggs that are expelled in the feces. The latter, "whip worms", whose eggs are able to withstand adverse environmental conditions, almost to the same extent as those of Ascaris, was commoner than the former and the "pinworm" *Enterobius vermicularis* was frequently found. *T. saginata* and *T. solium* have been noted by others in the area studied but were not observed by us.

[70] Sandground, J. H. Helminthic infections in Guatemala in a Medical Survey of Guatemala. Carnegie Institution of Washington, 1938.

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Mixed Worm Infestation in 100 Children From Zapuca and Waspam (Coco Basin)
Nemathelminthes

Age of Child	*Number of Children Infected*			
	Ascaris Lumbricoides	*Enterobius Vermicularis*	*Trichuris Trichiura*	*Necator Americanus*
5—10	56	31	60	10
10—15	21	16	56	13

Trichuris trichiura infestation was common throughout the population. However, as the children become older, and among adults, there was a decreasing incidence of infestations, other than Trichuris, proportionate to the age of the individual. It is presumed that as age increases the subjects are more careful about their habits and the ordinary methods of re-infection are reduced.

757 164 In treating intestinal parasites, the Indians use numerous decoctions made from tree barks. As far as can be ascertained the brews act mainly as cathartics and are not, strictly speaking, vermicidal. The effect of violent catharsis is two-fold. First, there is the psychological effect of direct action of the therapeutic of reducing a swollen abdomen and the consequent relief from distension or constipation, and second, there is a diminution in the quantity of parasites, since many were removed by cathartic action. The Indians, however, prefer our methods for treating intestinal helminths and seek such treatment whenever available.

THE INFECTIOUS DISEASES OF THE COCO BASIN

Yellow Fever

164 Carter's investigations[71] have revealed that yellow fever was a disease brought to the New World from Africa. The first epidemic occurred in Yucatán in 1648. Since then numerous epidemics of yellow fever have been described; the distribution of the disease and dates of occurrence have been listed by Hirsch.[72]

As far as could be determined yellow fever has not been reported from the eastern coast and the interior of Nicaragua. Dr. Thaeler, at Bilwas Karma, has never seen a case in this area and other investigators have suspected it in this region but were unable to discover its presence.

[71] Carter, H. R. Yelloyw fever: an epidemiological and historical study of its place of origin, 1931. Baltimore.

[72] Hirsch, August. Handbook of geographical and historical pathology. 1883. Vols. I and II, News Sydenham Society, London.

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The mosquito, *Aedes aegypti*, the transmitter of the disease, is common in the territory but is apparently uninfected. Even in the listing of Hirsch there is no report of yellow fever in Nicaragua until 1868 and it is possible for geographical reasons that the disease failed to appear in the Coco Basin. According to Raynal[73] several outbreaks of yellow fever occured in nearby Guatemala (San José, 1859; Escuintla, 1868; Retalhuleu, 1881 and 1895), and this would confirm Hirsch's notation of yellow fever in Nicaragua in 1868.

It must be recalled that a high mortality occurs from yellow fever only when the disease appears in a relatively non-immune population or when the disease has been carried to immune territories. It is possible therefore that the disease, if present at one time, could be quiescent in certain areas for a period of years and since small numbers of travellers visit central and eastern Nicaragua, very few, if any, infective people enter the territory. With this in mind it would appear plausible to suppose that the vector insect has not had opportunity for obtaining the virus.

Plague

Although common in Europe during the 16th and 17th centuries, plague did not reach the New World until late in the 19th century, when it appeared for the first time in San Francisco, México, and other scattered territories. Plague is unknown in the Coco Basin and as a result presents no public health problem.

Cholera

The first pandemic of cholera probably started in Indian between 1817 and 1823 but did not reach the New World until between 1826 and 1837.[73] In 1837, according to Bancroft[74] the epidemics of cholera began to make their appearance through Guatemala and in other parts of Central America; in Nicaragua in 1855 it became a serious problem. In 1856 it crippled Mora's army in Nicaragua and continued its course. Walker's army was devastated by it.[74] The disease spread quickly throughout Central America and continued in El Salvador and Guatemala until near the end of 1857. It broke out again in Nicaragua in 1866 and continued in Honduras until 1871. In spite of the poor sanitary conditions today the presence of the disease has apparently

[73] Raynal, J. Annales de médicine et de pharmacie coloniales. 1932, *30*, 59, Paris.

[74] Bancroft, H. H. History of Central America, 1883, 1887, vols. 7 and 8. San Francisco.

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not seriously manifested itself. It apparently has not made its appearance in the Coco Basin and no knowledge of it can be found for the territory.

Smallpox

The exact date of the introduction of smallpox into the New World is not well known. In Mexico, Bernal Díaz[75] states "a negro was in the smallpox: an unfortunate importation for that country for the disease spread with considerable rapidity, and the Indians died by the thousands"; this was in 1520. Since then there have been numerous ravages of the smallpox in various portions of Central America, however, there is no apparent history of the disease in the Coco Basin and if it did exist it would have been localized to a great extent to the smaller communities. The great outbreaks of smallpox in Costa Rica in 1862, in Guatemala and Honduras in 1883, was escaped by Nicaragua due to vaccination. Most of the visitors to the Coco Basin had already been vaccinated and this fact alone presumably supports the view that the disease is relatively rare in that territory.

Measles

The exact date of the introduction or recognition of measles in the New World is unknown. Hirsch states that measles was not recognized in Europe as a specific disease before the 18th century. Zinsser[76] on the other hand claims that measles was common among the natives of the New World in 1595 but that it was probably brought to America from the Old World. The disease has been a serious one to the Indians generally throughout Central America but for some particular reason it is fairly rare in the Coco Basin and only a few specific cases have been reported.

Typhus Fever

As far as can be ascertained typhus fever is extremely rare or does not occur among the Miskito Indians of the Coco. The disease apparently is of European origin but for some reason or other infected rats have not been introduced into eastern Nicaragua.

Whooping Cough

Whooping cough was introduced into America from Europe and caused the death of thousands of Indians and is particularly fatal to

[75] Díaz, Bernal. The true history of the Conquest of Mexico. Written in the year 1568. Translated by Maurice Keatinge: 1803. 2 vols. Salem and London.

[76] Zinsser, H. Rats, lice and history: 1935. Boston.

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them.[77] Sporadic epidemics of whooping cough have occurred in the Coco Basin and have always continued with considerable severity. Thousands of deaths from whooping cough were reported to the League of Nations in 1933 and 1934.[78] In the Coco Basin the children in a few villages have come down with this disease but because of the wide gaps between villages it has never spread entirely throughout the area. In short, the epidemics appear to become localized and have within the last 50 years decreased considerably in number. Thus, it can be said that considerable morbidity and mortality for whooping cough does occur at intervals of them but are localized in character.

Diphtheria

Diphtheria appears to be a relatively rare disease in the tropics; for instance, in the non-tropic areas such as Buenos Aires, the incidence per 100,000 persons was in 1929, 16.9; in Quebec, 23, and in Chicago in 1927, 13.8. In the tropic area in 1927 for Havana was 1.5; in 1928, 2.0; Guayaquil in 1930, 0.8; Veracruz in 1930, none; in Kingston in 1927-1929, none. Further north in Tampico the incidence was in 1930, 6.0; and in the Panama Zone in 1928, 9.9. Larsen[79] states that in the tropics diphtheria is a mild, seldom seen disease and rarely assumes epidemic proportions. This is of interest since Emerson[80] has shown that there is a significant difference in the cause and death incidence rates of diphtheria in various racial groups in New York City and he believes that the factor of race is the only one of importance which can be recognized. Be this as it may, the fact remains that today no case of diphtheria has been reported in the Coco Basin territory. This does not mean, however, that mild cases have not occurred since the disease might have been mistaken, if mild, for any of the upper respiratory diseases.

Pneumonia and Bronchial Pneumonia

At the time of our expedition through the Coco Basin we did not hear or not did we see any cases of pneumonia; however, we were in-

[77] Gann, Thomas, In an unknown land. 1924, New York.

[78] League of Nations Health Organization. Annual Epidemiological Reports, Geneva. For the year 1933, published in 1935; for the year 1934, published in 1936.

[79] Larsen, A. E. Variation of cosmopolitan diseases in tropical and temperate zones. Amer. Jour. Trop. Med., 1936, *16*, 91.

[80] Emerson, K. Future of program for tuberculosis control. Amer. Jour. Public Health, 1935, 25, 707-711.

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164 formed that pneumonia and bronchial pneumonia did exist and that at
171 certain times the disease would occur especially among infants with a very high morbidity and mortality. Pneumonia is however more common in the highland tropics. For instance, in Guatemala, where the incidence is equal to that of México, it is more than double than that for Massachusetts. The disease in the Coco Basin is not of paramount importance nor is it a public health problem. No statistics are available so that a proper description of this disease can not be given.

Tuberculosis

Hrdlicka[81] has said of pulmonary tuberculosis in Indian tribes that "this disease which in all probability is extremely rare, if it exists at all, in the prehistoric Indians, was seldom seen before a century ago (before 1808) and is gradually becoming everywhere more common". His observations indicated further that pulmonary tuberculosis in the Indian is usually fatal within a comparative short time.

But it has been noted[82] for instance in Guatemala that tuberculosis is an important cause of death in the larger cities; it is not prevalent in small communities. The real question, as raised by Shattuck, is does tuberculosis treaten to become a major problem in Central America. If so, little has been done to combat the disease in this area. Yudice[82] applied tuberculin tests to 447 children in El Salvador and found the Pirquet test positive in 47 per cent of the subjects (children 3 to 14 years old), and those in whom it was doubtful or negative gave 21 per cent positive Mantoux tests. In the reports dealing with North American Indians, Crouch[83] found 75 per cent positive among Indians of Montana and Coleman[84] stressed the view that Navajo Indians had practically no immunity to the disease. The factors involved appear to be those of racial susceptibility, poor food, bad hygiene, and the lack of treatment of contributing causes.

164 Although we were not able to secure the incidence of pulmonary tuberculosis among the Miskito Indians, two facts seeemed apparent. The first of these was that fever, cachexia, hemoptysis symptoms which developed rapidly and often terminated in death were common in the younger Indians who worked in mines. The other fact is that such

[81] Hrdlicka, Ales. Smithsonian Inst. Bur. Amer. Ethnol. 1909, Bull. 42.
[82] Yudice, Luis. Salv. Med., 217, ab. 1936. (Abstract in Bol. de la Oficina Sanitaria Panamerican, Sept. 1936, 883.)
[83] Crouch, J. H. U. S. Public Health Reports, 1932, 47, N° 38, 1907.
[84] Coleman, Nancy R. The Reservation Boarding Schools, Bull. 25, (Nov 1936), Natl. Assoc. on Indian Affairs, Inc., New York.

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clinical findings were rare among in Indians living in isolated villages and in those who subsisted on game and agriculture. This observation appeared to be common knowledge. 164

One case of tuberculous pleurisy with effusion was noted in a twenty years old boy and Bilwas and this subject was the only noted by us during the entire journey into the Coco Basin.

Malaria

In considering Central America, in 1881, Hirsch[72] has pointed out "that malarial diseases have their chief seat on the Atlantic (gulf) coast from Chagres up to Cape Gracias a Dios, and on the interior plain up to a height of 600 meters". Even though the disease occurs throughout the lowlands of Central America, there still remains today, the same striking disease problem on the eastern Atlantic areas. In fact, Malaria constitutes the major public health problem of the Miskito Coast.

Historically it is difficult to trace the presence of malaria in the New World prior to the conquest. In 1519, Cortes, Father Olmeda and Diaz had attacks of fever and similar illnesses occurred among some of their soldier[74] but the disease was mild and few deaths were attributable to it. There is no evidence that the military campaigns were handicapped by the fever. Stitt[85] in *Our Disease Inheritance from Slavery* lists tropical malaria (aestivo-autumnal) and black-water fever among the diseases introduced from Africa, and Carter[71] is "inclined to think that malaria did not exist in America prior to its discovery. It would of necessity have been introduced early by the Europeans and Negroes, and, *Anopheles* being generally present, it would have spread." On the other hand Joyeux and Sice[86] in quoting Paez say that malaria was present in Mexico prior to Columbus.

Malaria, clinically, is protean in character and follows no given set of rules. The contributing factors are many. These are the species of parasites and their biological properties, the severity of infection, the age and race of the patient, his resistance to the disease, the effects of relapse, the kinds and amounts of therapy used and the important aspects of intracurrent, recurrent and terminal infections.[87] The di-

[85] Stitt, E. R. U. S. Naval Med. Bull. 1928, 26, 801-833.

[86] Joyeux, C. and Sice, A. Precis de Medicine Coloniale, 1937, Masson et Cie. Paris.

[87] Cannon, P. R. Some Pathologic aspects of human malaria. Symposium on Human Malaria (Ed.: Moulton, F. R. 1941, American Association for the advancement of Science, Washington.)

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[164] sease debilitates the population, reduces the activity and energy of the workers, depresses the intelligence of the children and diminishes fecundity. Since the Miskito coast abounds in mosquitoes especially those that carry the disease, it is only reasonable that malaria constitutes a major public health problem of the area.

In the Coco Basin, most of the inhabitants are either in the throes of malaria, in a period of remission or have had the disease: the exact status being difficult to differentiate. A swelling of the spleen, anemia, fever are most commonly attributed to malaria *(Wrih)*. For malarial [757] fevers the bark of certain trees are administered, particularly copalchi *(Cinchona sp.)* The stricken person is enveloped in *tunis* blankets with hot stones placed at his feet, forthwith he is often taken to the river and given a cold bath.

The high incidence of malaria is due to two reasons, the first being the large numbers of anopheline mosquitoes capable of transmitting the disease and secondly the numerous sources of host reservoirs for the parasite. Thus the infected and the infectors are numerous. The higher death rates (impression) occur among the very young and the aged. At San Carlos the death rate from malaria, between the ages of 2 to 10 years of age, is approximately 12 per cent. Most of the [165] aged, we were told, died of fever and the older people on occasion sing this chant:

[539] *"The fever returns and I shall die. I drink medicine put it on my body. The fever will kill me and I shall die. The medicine does not help me. I have been good to my family. I have had the fevers. This time it (the fever) will take me."*

[122] Our investigations were primarily directed to children because they, not being at work, were easier to secure and examine and it was easier to determine exactly the incidence of autochthonous malaria in each locality. Furthermore the children rarely leave the community and among them are fewer imported cases. However certain of the older people were examined and these are included in this report.

Children according to Brumpt[83] may be considered as a reservoir of the disease. If such is the case, then, San Carlos community becomes an ideal location for the preservation and increase of the disease. The possible reason for the lower incidence of malaria at Saulpaca is that within a few miles of this community Dr. David Thaeler maintains his clinic and hospital. Thaeler has furthermore been instrumental in teaching the people the principles of swamp drainage and malaria control. It would be reasonable to expect that in

[83] Brumpt. E. Precis de Parasitologie, 4th ed., 1927, Paris.

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Combined results of the malarial survey at Saulpaca (Zapuca) and San Carlos 164

Age	*Total N° of Persons*	*Spleen examination Positive Splenomegaly*		*Positive Blood smear for parasites*	
Years		*Saulpaca*	*San Carlos*	*Saulpaca*	*San Carlos*
0-1	40	0	11	6	10
2-4	46	2	15	13	17
5-9	128	3	52	46	55
10-14	80	2	34	27	36
15-19	41	2	18	14	20
50-54	34	0	8	8	9

the proximity of Bilwas Karma where certain public health measures have been introduced to expect a decreased incidence of disease. However the problem of clinical malaria remains a challenge and suppressive measures with atabrine or similar drugs may do much for these communities; the use of effective insect control with modern insecticides may play a major role in the future village control of insect borne disease. From the values given in the examination for malaria it is obvious that the disease constitutes the mayor health problem of the area. At Waspam, Bilwas Karma, the following mosquitoes were collected by [136] our party, these were: *Anopheles albimanus, A. albitarsis, A. aquasalis, A. argyritaris, A. parapunctipennis, A. pseudopunctipennis,* (several varieties), *A. vestitipennis, and A. crucians* (reported to be collected by Kumm). *A. albimanus* was found in great numbers and is probably the principal transmitter of malaria. This species is found in humid tropical climates and its breeding places are in the swamps exposed to the sun. However it has been known to exist at altitudes of 1350 meters (Guatemala City) and is the most common vector.

Syphilis

Hrdlicka[80] has pointed out that there is no substantial evidence 164 of precolumbian syphilis. On the other hand Williams and Wakefield, 114 Dellinger and Camp[80] regard the conclusions of their studies as being 171 sufficient to substantiate the view that syphilis was endemic in North America prior to European contacts. Regardless of controversy, sy-

[80] Hrdlicka, A. Disease, medicine and surgery among American aborigines (Geo. M. Kober Lecture). Jour. Amer. Med. Assoc. 1932, 99, 1661.

[80] Wakefield, E. G. Dellinger, S. C. and Camp, J. D., Study of osseous remains of "mound builders" of eastern Arkansas. Amer. Jour. Med. Sciences, 1937, 193, 443.

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phils, today among Indians, is a disease that deserves further study. Dr. Mitchell Frank[91] has repeatedly stated that many cases with positive serologic evidence do not show clinical manifestations of syphilis nor is there anything which could be construed to indicate syphilis in the history. He points out furthermore that some of these cases on treatment have changes in serological findings but others do not. He has endeavored to perform all of precipitation — flocculation was well as the modifications of the Wasserman reactions and he is not satisfied with the status of this subject among Indians. Lynwalter[92] in 1923, in a study of Pueblo Indians found that 31 per cent had serologic evidence of syphilis and Dr. Frank does not believe that all these subjects were endowed with the disease. Plant[93] in South Dakota found serologic positives in Indians in 10.9 per cent of the men and 7.3 per cent of the women; Clarke[94] in New Mexico showed a serologic case rate of 1.5 for Indian males and 2.3 for Indian females. Dunham, Aberle, Farquhar and D'Amico[95] stated that positive serologic evidence was present in 2 per cent of the Indian children; Mountin and Townsend[96] report on incidence of 6.6 per cent among Indians studies. Pierce[97] has stated that there is something peculiar to the results obtained with precipitation flocculation tests among Indians and that the Wasserman reaction may be involved as well. Other considerations are the changing nature of the disease itself as exists over a period of years within a community and the effects of interracial marriages.

With regard to syphilis in Central Nicaragua, Rosenfeld[90] in his report stated "syphilis too is apparently very prevalent, several cases suggesting congenital and central nervous infections having been observed". It was, however, our impression that syphilis when present existed only in certain communities and rarely in others. Although there was no opportunity to perform routine serological testing, the clinical evidence of the disease was rare in all of the small

[91] Frank, Mitchell, Senior Physician, United Pueblos Agency, 1943, personal communication.

[92] From the Office of Indian Affairs, Washington, D. C. 1923.

[93] Plant, F. Paralysestudien bei Negern u. Indianern. 1926, Berlin.

[94] Clarke, W. Sangre impura in Mora: study of syphilis and certain other diseases in population of Mora County, New Mexico. Ann. of Int. Med. 1934, 7, 1936.

[95] Dunham, E. C., Aberle, S. D., Farquhar, L. and D'Amico, M. Physical status of 219 Pueblo Indian children. Amer. Jour. Dis. Children, 1937, 53, 739-49.

[96] Mountin, J. W., and Townsend, J. G. Treas. Dept. Pub. Health Service Bull. 1936, Bull. 223 (Feb).

[97] Pierce, L. F. Personal communication, 1943.

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villages on the Coco River. In and around Waspam, San Carlos, and Bilwas Karma several cases were seen which appeared to have the stigmata of the disease. Dr. Daniel F. Molloy of the Rockefeller Foundation once informed Dr. George Shattuck [82] that yaws in Honduras and in Nicaragua occurred in "nests". It was our impression that the same can be said for syphilis. Several cases were seen in and about Bilwas that were being treated and although the disease does not present itself as a major Public Health problem within the Coco Basin it is important that it be treated since there is every likelihood that it will spread.

Yaws

Yaws is a common disease in the tropic regions of Central America and it is often seen in the subjects of the Coco Basin. There appears to be some evidence that Yaws was an ancient disease in the Americas. Hirsch [72] and Shattuck [82] agree that yaws was an importation from Africa. In a survey of a hundred patients as San Carlos nine of them yaws, three of the subjects were boys between the ages of 10 and 18 who had the typical secondary eruption of yaws. The other six patients had a mixture of annular tertiary lesions and chronic eruptions. Treponema was demonstrated in four of the patients. Although no formal survey was undertaken, Dr. Thaeler and others[96] had the impression that the disease was common in the area. The treatment of the subjects with mapharsen and bismuth salicylate results in a dramatic response, and at the end of the third weekly injection most of the lesions had disappeared. It would appear to us that a definite program could be established with regard to the treatment of yaws wherein a sustained effort in a field project coud accomplish the treatment of the majority of the cases within a short period of time. Thus a team could enter into a territory and make a definite tour with a view of treating yaws. Although the disease would probably not be eliminated by such a measure it would no doubt be suppressed in its spread to a where it might considered a minor public health problem.

Pinta

The disease pinta is characterized by changes in pigmentation as a result of *Treponema Carateum* infection. Is is presumed to be of

[96] Rosenfeld, L. in his survey of March, 1943 found among 200 subjects at Raiti and San Carlos, 26 of them with yaws and 18 of them with Pinta and 2 with both diseases combined.

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164 pre-columbian origin. The disease was found to occur in 10 per cent of the population examined, some villages having more of the disease than others. Aside from discoloration of the skin no other symptoms could be found and it appeared to have little effect on the body economy of an individual. However, many persons were conscious of the discoloration, felt shy because of it and presumed themselves to be unclean. The disease was common in certain families and not in others though there seems to be no evidence for congenital transmission[99]. So far little or no treatment for the disease has taken place in this area.

Dysentery

If by dysentery we mean infectious diarrhea then this disease is not only prevalent in the tropics but it is associated by high morbidity and mortality. And since it is epidemic in quality it is bacterial in origin.* However it must not be forgotten that dysentery is a loose term denoting mainly a symptom complex. As such the disease can be caused by amoeba, by the ciliate *Balantidium coli*, by malaria (P. falciparum), by certain worms, and by *giardia*. The two most common types of dysentery are bacillary and amoebic and of these two the former is our primary concern.

Bacillary dysentery is common throughout the year in the Coco River basin but has its greatest epidemic quality during the beginning and end of the rainy seasons. The childhood mortality rate from the disease although not exact takes a toll of approximately ten per cent of the children afflicted by it. As far as could de determined with limited equipment the common etiological agent is *Shigella paradysenteriae Flexner*, an organism utilizing glucose, mannite, but not lactose or dulcite. [136]

164 514 The disease occurs chiefly in the larger villages; in the smaller villages it may be rare or have never occured. This is of interest from an epidemiological point of view since in some of the isolated small villages the carrier or the source of the organism is not available. In the larger villages, an example of which is San Carlos, the disease may debilitate a third to one half the population. In our opinion, at San Carlos the disease may be traced to certain wretched latrines within the business section of the village. Some of the latrines have been erected at considerable cost; others are make-shift devices for the conveniences of their owners. Regardless of cost the screens because

[99] Mackie, T. T., Hunter, G. W. and Worth, C. B. A. Manual of tropical medicine. Philadelphia, 1945.

* Dysentery bacilli, Salmonella, Staphylococci, etc.

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of rain and humidity have eroded, the pit fills with water and the entire construction fills with flies. The dysentery epidemics at San Carlos usually begin about these latrines and extend to the periphery of the village. 164 514

Another contributing factor to the spread of dysentery is that in some areas well meaning visitors have encouraged the use of milk for children. In a territory devoid of refrigeration or adequate sterilization the use of milk should be derived from the mother's breast or directly from the cow's udder. On the other hand milk products such as cheese are less likely to be infected. Nevertheless, milk fluid serves as an excellent bacterial medium. Powdered milk might obviate such a hazard. 164 262

Drinking water in the larger villages may be considered a source of infection since water may be stored in containers not ideally suited for such a purpose or the water may be collected from the main river or other pools simply because the source is conveniently located. 164 312

The Indian customs are such as to depress the occurrence of dysentery. These customs are to drink water from clear running creeks (see map of San Carlos), and to perform their ablutions either in the large river or to dig holes for their excremata. If holes are dug in the bush they are immediately covered up after use. The Indian, unless educated otherwise, considers the communal use of a structure such as a collecting booth for feces and urine as an evil. It would thus appear that the invading culture (Spanish American) with its convenient latrine often in juxtaposition to the latrine, has furthered the dysentery problem. 164 514

Some of the latrines observed were of such a character that even the investigators used to the inconveniences of the bush felt repelled by the utterly uninviting stench and the great scatter of soiled paper throughout the establishment. Toilet paper, in many tropical areas of high humidity, offers itself as a remarkable medium for growth of molds which renders the paper useless. Latrines built by special sanitary engineers were misused, had eroded screens and were halt filled with water. During the dry season when they were erected they were presumed to be ideal and satisfactory in every way.

If the wretched latrine is to be used, the use insecticides and disinfectants must be encouraged, otherwise dysentery will be present. The authors of this report endeavored to encourage the Indian practice of waste disposal.

Amoebic dysentery exists as far as could be determined in from 2-5 per cent of the population. Stool examinations at Waspam, revealed that 7 per cent of the adults and 2 per cent of the children had 164

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164 evidence of amoebic dysentery. Many of the patients were symptom free but gave clinical histories of occasional periods of cramps and blood and mucous in their stools. One person was seen in exhaustion from the chronic diarrhea of feces mingled with blood and mucous (sago-grain stool). Most of the people with the disease complain of easy exhaustion and appear to be chronically fatigued. This disease like bacillary dysentery is commonest in the larger villages where food has a greater opportunity to be contaminated by fecal matter or infected water. In isolated smaller villages the disease is rare, if ever present. The source of amoebiasis in such areas is not always simple to ascertain since many persons eat the same food and some become infected and others not. The role of carriers of the disease requires a special study which we were unable to perform.

Skin diseases

In many communities people are afflicted with tropical skin sores presumably of fungous origin. The diagnosis of the lesions is difficult, smears observed under the microscope reveal mycelia of all varieties. Certain ulcers may be of spirochaetal or bacterial etiology but we were not sufficiently specialized to assume the responsibility of a specific diagnosis. The persons in about one fourth of many communities have with some sort of mycotic lesion, in other communities skin diseases may be less in number. Needless to say there is no satisfactory method of treating the majority of such lesions. The usual lotions containing Salicylate, thymol, cooper sulfate, etc. may offer temporary improvement or increase the dermatitis. It would seem difficult to suppose that topical application of some agent would attack a mycelar structure extending into the deep tissues. It was our impression that a systematic drug was needed that would have fungicidal or fungistatic effects. Many of the natives informed the observers that lesions began as a chigger sore or as a result of an insect bite and one may speculate that fungus infection may occur in certain areas of the skin where a break in structure has occured. It is therefore recommended that sores or bites are treated with fungicidal agents providing, of course, that the agent does not in itself provoke a dermatitis.

Summary of disease among Coco River Miskito Indians:

Suggestions for amelioration

000 The salient public health problems of the Coco River Basin are

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primarily malaria, intestinal helminths, dysentery, and mycotic dermatoses and secondarily yaws, pinta, tuberculosis in mining districts.

The first suggestion towards amelioration is at least some understanding of the disease problems in an area and within that area of the peculiarities of a local situation. What for instance may offer a solution at San Carlos may not be exactly the case at Waspam. The second suggestion is to know the people with whom one is dealing. Their customs and ways are of utmost importance to a medical program. The physician should be a medical expert of society and if the society in which he moves is unable or unwilling to accept his methods then all of his efforts are in vain. If medical care is needed anywhere, the physician must adapt himself to the circumstances and provide health measures and services.

Among many Indian tribes, medicine and health are symbols the understanding of which belongs to the medicine man. He is a combination of sorcerer, priest and physician. It is only this combination that is satisfactory to the care of a society under certain circumstances. The sudden arrival of modern medicine in such a community does produce a conflict within the minds of the natives. How difficult it is to deal with persons within our own culture who for years have followed treatment dictated by popular belief, superstitions or views forced upon them by commercial interests. The field of patent medicine is a flourishing market and represents both inadequate and improper education of the public or the inability of the physician to cope with the social situation. The problem among native peoples is even more difficult and requires in the main a common sense approach towards human understanding based primarily in the recognition of feeling and sympathy for ones fellow-men. Observation, experience, experimentation and reasoning are the sources of knowledge.

The friendship of the people is to be desired and the cooperation of medicine men *(curandero, sukia)* is solicited. Wherever possible one is an aid to these people, working with them towards a gradual understanding of their problems. One collaborates with the shaman for he himself has a special role in society. Among the Miskito modern medicine is already known. The people understand the meaning of our anti-malarial drugs. Their own public health measures are fairly satisfactory and what is needed are specific control measures for certain diseases. This situation is peculiar to the Coco Basin and may differ elsewhere.

Since the medical care of the Coco Basin people is limited, in the modern sense, to but one physician and since medical care is needed throughout the area it is obvious that we must adapt our method of

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759 rendering health service to this situation. Physicians, in general, find the territory unremunerative and as a consequence cannot be induced to venture or remain in that region. We are therefore confronted with the problem of adapting our method to the situation even though the procedure introduced may not be ideal.

For this reason Dr. Thaeler at Bilwas Karma has trained young men to act as agents for the central clinic. The men arrive at Bilwas Karma and undergo a serious series of lectures and demonstrations, then a period of internship and are forthwith prepared to carry out limited medical activities in the communities from whence they came. In this process of adaptation it is important that the trainee return to his original community, for his people know him, place trust in him, and adaption to a porgram is simplified. Furthermore the trainee is at ease with his own people, his prestige is increased and his relatives offer adequate security for his success.

K4 The diseases in which an empirical diagnosis can be made with a
759 medicum of success are as follows: malaria; yaws; pinta; acute dysentery (presumably bacillary); chronic weaking dysentery; (presumably protozoal or helminthic); helminthes; and skin infections. The trainee is taught mainly in terms of these major diseases, first aid and rudimentary principles of child-bearing and pediatrics are secondary. The system ordinarily employed by the Indians in first aid is not to be condemned, obstetrics and pediatrics do not constitute subjects of sufficient public health importance to this region. The trainee is taught insect control measures and the use of certain specific drugs for the diseases just described. His medical supplies consist chiefly
278 of atabrine, oil of chenopodium, magnesium sulfate, sulfaquanidine, viaderm, carbarsone, antiseptics, gentian violet pills, a few miscellaneous drugs such as aspirin and some first aid equipment. The trainee is taught to send many of the patients whom he regards as special cases to the hospital. There is a possibility that such a system may
080 succeed, particularly if the trainee or agent is brought back to Bilwas for refresher courses. The merits of the system result from one basic fact and that is that Dr. Thaeler is a well trained clinician with considerable understanding of these Indians. It seems highly important that such a program be directed only by a well qualified physician or physicians who have had special training in medicine as applied to societies of varying cultural traits. This fact has been recognized to some extent by the British in their various schools of tropical or colonial medicine and by the United Fruit Company. In other instances tropical medicine may be academically isolated from the societies who should receive the results. The mistakes made by young physicians,

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without training in social affairs, who are sent partially trained to ~~~ regions containing peoples of different culture are too numerous to be cited. This situation alone is responsible for much of the limited success of the Indian Medical Service in the United States, and for that matter the role of the average physician in the society in which he lives. The plea is obviously one for further experimentation, there is no concise rule or formula to be applied. But special training is a requirement that must not be overlooked. Learning by experience alone is too long and too costly.